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TELE-TECH

& ELECTRONIC INDUSTRIES—RADIO-TELEVISION

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SERIAL RECORD
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In this issue:

- Microwave Devices for Testing Magnetrons
- TV Control Room Layouts
- Core Materials for Small Transformers

October • 1952

1953 HEMISPHERE STATION & STUDIO EQUIPMENT DIRECTORY

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Why Do Leading TV Makers Specify RMC DISCAPS?

Manufacturers specify DISCAPS because they provide faster assembly line production and lower over-all costs.

Why Do Engineers Specify RMC DISCAPS?

Engineers specify DISCAPS for their uniform quality, low inherent inductance, high working voltage and greater mechanical strength.

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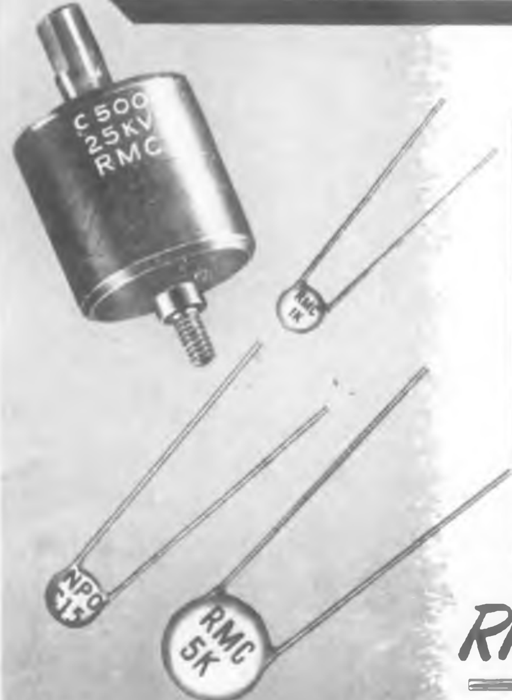
Purchasing agents specify DISCAPS because they can depend on RMC to make delivery when scheduled.



RMC offers a full line of by-pass and temperature compensating DISCAPS. Proved in use as a money-saving replacement for mica and ceramic tubular capacitors, DISCAPS are widely used by leading manufacturers of TV sets and tuners, radio receivers and high frequency electronic equipment. If you are interested in improving the quality and uniformity of your product, you will be interested in RMC DISCAPS.

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OCTOBER, 1952

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Edited for the 19,000 top influential engineers in the Tele-communications and Electronic Industries, TELE-TECH each month brings clearly written, compact, and authoritative articles and summaries of the latest technological developments to the busy executive. Aside from its engineering articles dealing with manufacture and operation of new communications equipment, TELE-TECH is widely recognized for comprehensive analyses and statistical surveys of trends in the industry. Its timely reports and interpretations of governmental activity with regard to regulation, purchasing, research, and developments are sought by the leaders in the many engineering fields listed below.

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- ★ *Accurate low impedance measurements with the V-H-F Bridge — measures high impedance indirectly*
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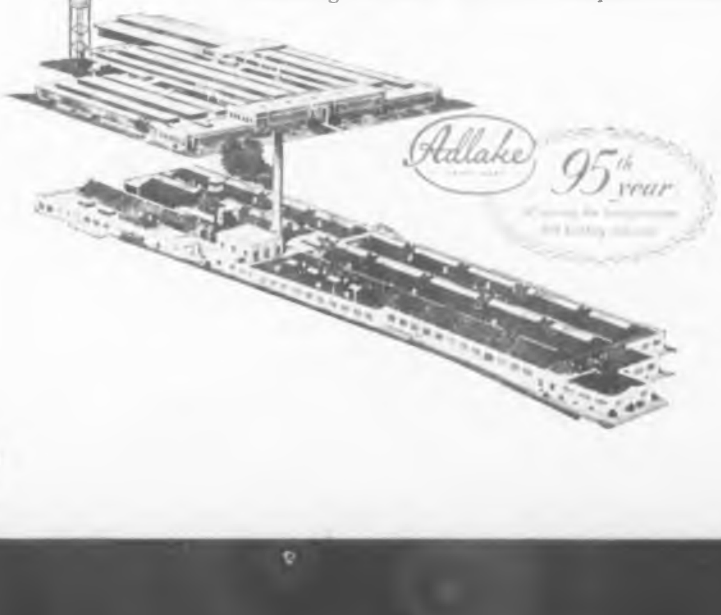

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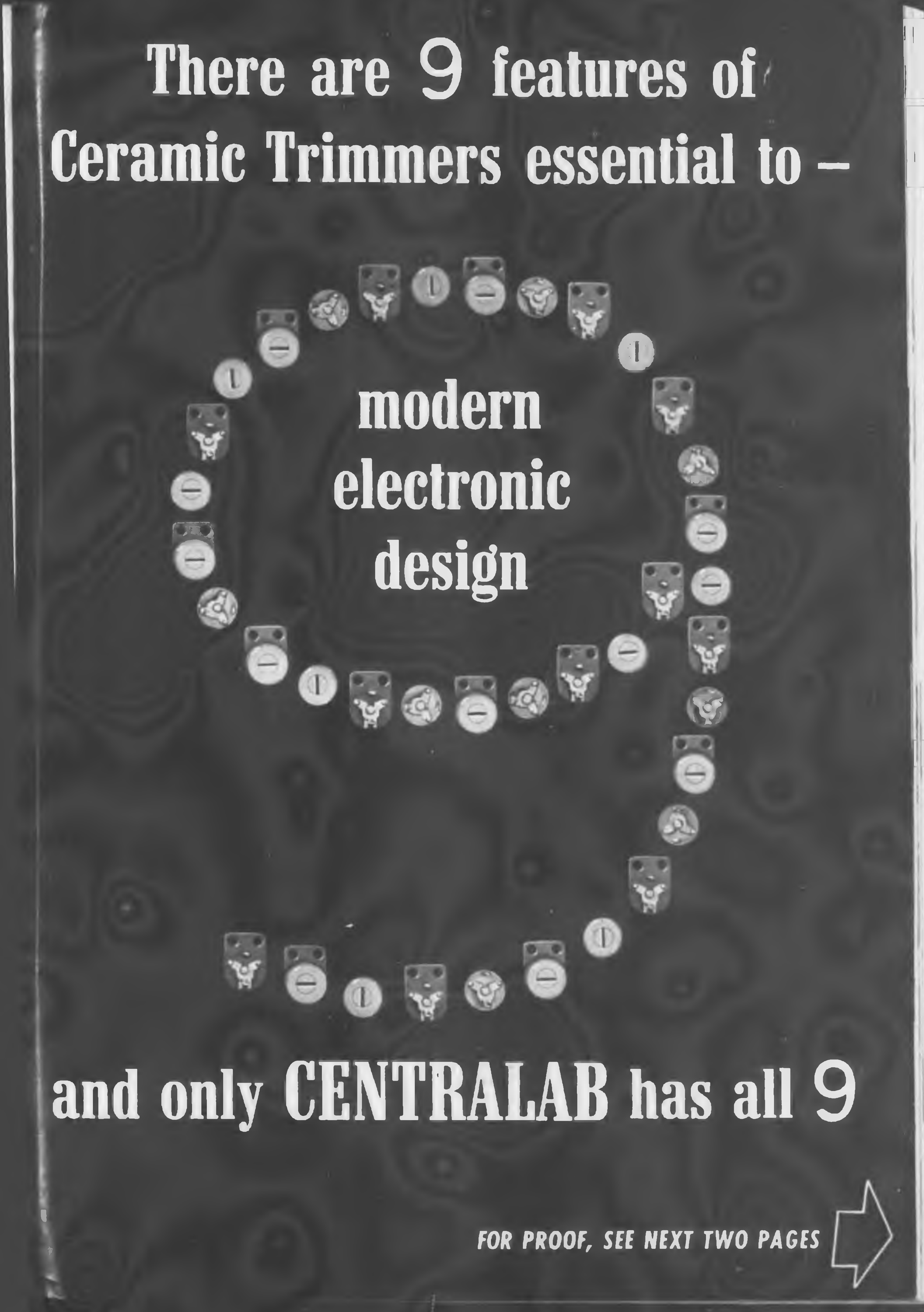
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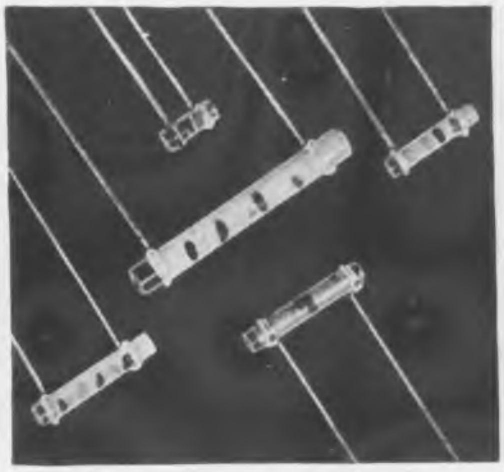
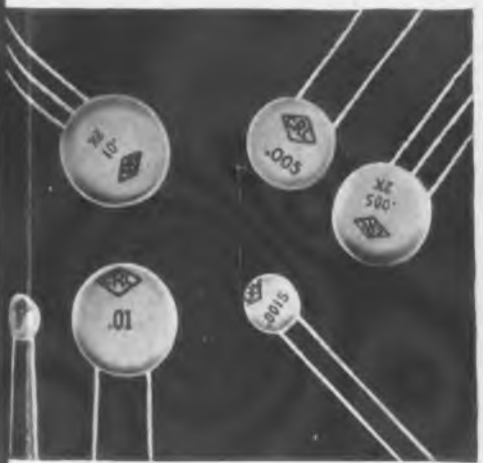
BC HI-KAP TUBULAR CERAMIC CAPACITORS available from 1 mmf to 10,000 mmf. Ideal for use in r.f. by-pass and audio-coupling applications. For details, write for Bulletin 42-3.



TUBULAR CERAMIC CAPACITORS — Type TCZ show no capacitance change over wide temperature range. Type TCN special ceramic body varies capacitance with temperature. Write for Bulletin 42-18.

TV HI-VO-KAPS are the standard high-voltage capacitors for the TV industry. Capacitance: 500 mmf, 10 KV, 20 KV and 30 KV D. C. working. Write for 42-10R.



CERAMIC DISC HI-KAP CAPACITORS hold thickness to a minimum. Make possible very high capacity in extremely small size. Used in HF by-pass and coupling. For details, write for Bulletin 42-4R.

HIGH VOLTAGE CERAMIC CAPACITORS. Capacitance: 5 to 500 mmf, 5KV to 40 KV D.C. working. Ideal for portable or mobile equipment and high-voltage, high-frequency gear. Bulletin 42-102.

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Please send me the Technical Bulletins on Ceramic Capacitors as checked:

☐ EP-16 ☐ 42-3 ☐ 42-18 ☐ 42-10R ☐ 42-4R ☐ 42-102 ☐ EP-15

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many more voices

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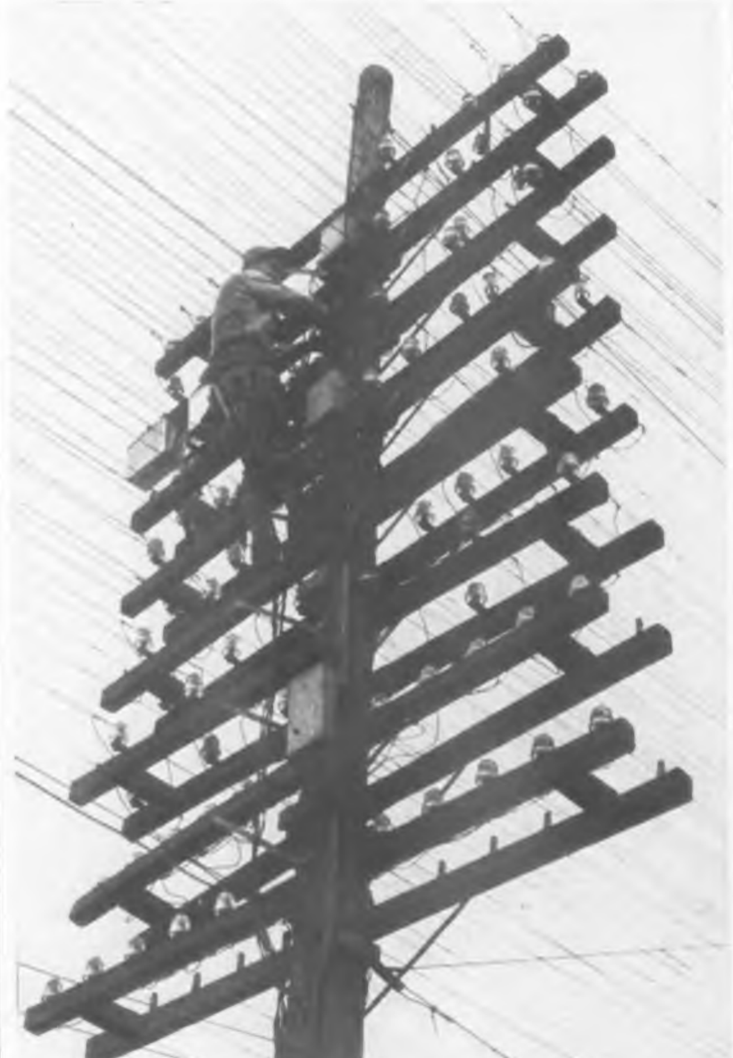

MUCH of your Long Distance telephone system works through cable but open-wire lines are still the most economical in many places. Thousands of these circuits are so short that little would be saved by using elaborate carrier telephone systems which are better suited for long-haul routes. But a new carrier system . . . the Type O designed especially for short hauls . . . is changing the picture. It is economical on lines as short as 15 miles. With Type O thousands of lines will carry as many as 16 conversations apiece.

Type O is a happy combination of many elements, some new, some used in new ways. As a result, terminal equipment takes up one-eighth as much space as before. Little service work is required on location; entire apparatus units can be removed and replaced as easily as vacuum tubes.

Moreover, the new carrier system saves copper by multiplying the usefulness of existing lines. For telephone users it means more service . . . while the cost stays low.

Repeater equipment is mounted at base of pole in cabinet at right, in easy-to-service position. Left hand cabinet houses emergency power supply. System employs twin-channel technique, transmitting two channels on a single carrier by using upper and lower sidebands. A single oscillator serves two channels.

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By whatever factor you consider most important, IRC filament type BT resistors lead the industry. The next time you specify insulated composition resistors remember—it pays to do business with the leader. Most people do.
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IF GLOBAL ACCEPTANCE REFLECTS LEADERSHIP— ***remember*** **IRC filament type BT resistors are favored in every major market of the world. Licensee plants in Canada, England, Denmark, Belgium, Italy and Australia produce IRC BT's for international electronics.**

IF DEPENDABLE DELIVERY REPRESENTS LEADERSHIP— ***remember*** IRC's long record of strike-free labor relations protects your assembly lines. Dependable delivery of Advanced Type BT resistors is further assured by IRC's financial ability to maintain large stocks of wanted ranges and to draw from foreign licensees when demand warrants it.

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This coupon brings you full data on IRC BT Resistors

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Please send me full data on IRC Advanced Type BT Resistors—

☐ Also name and address of nearest IRC Distributor who can furnish speedy delivery of BT resistors in small quantities.

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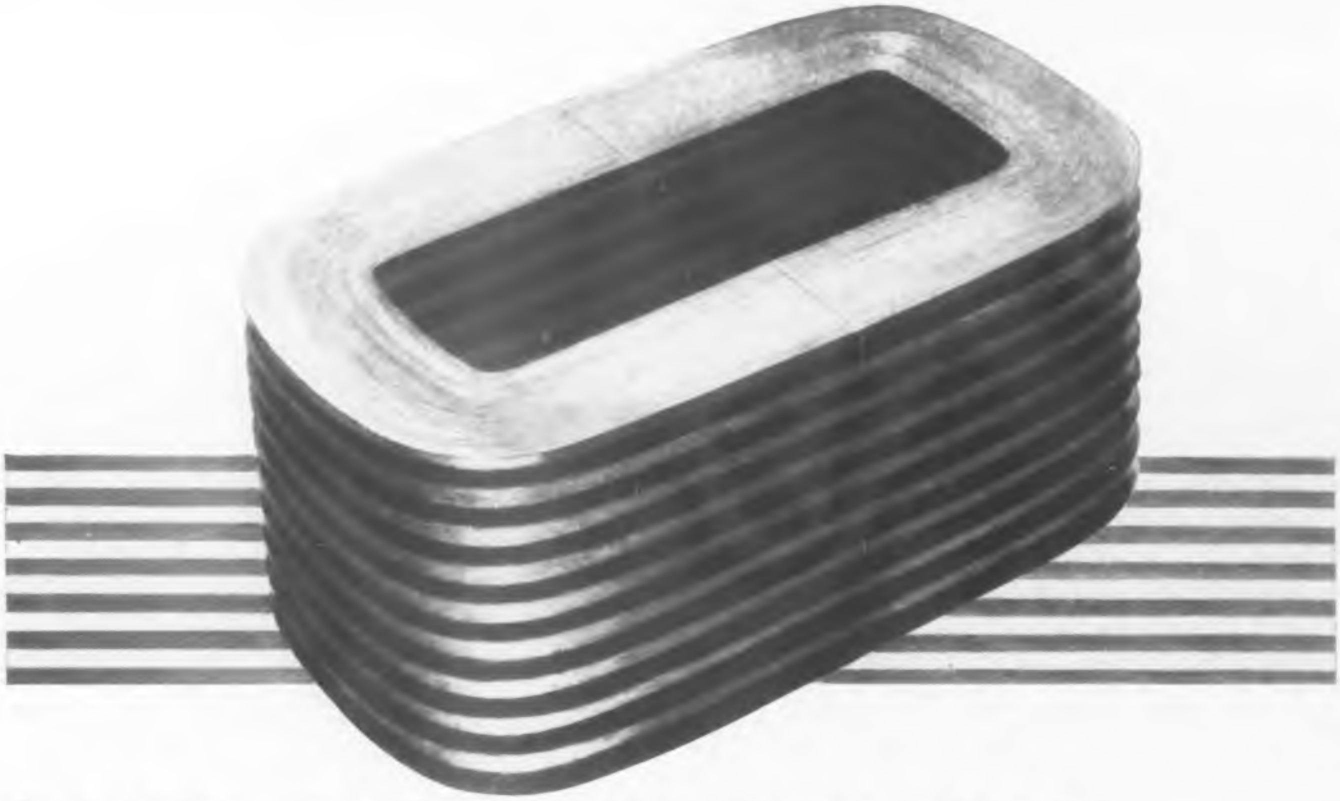

NEW RIBBED DESIGN stabilizes core performance!

Latest in a long line of transformer core advancements, ribbed design gives additional stability to the inherent high level of Hipersil® Core performance.

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You can cut size, weight and assembly costs in all types of electrical and electronic transformers with Hipersil Cores. They combine highest permeability with lowest losses in a wide range of sizes, for all frequencies (1 through 12 mil cores). Greater flux-carrying capacity, increased mechanical strength help make them the best core on the market. For specific information on how to apply them to your product, write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70629

YOU CAN BE **SURE**...IF IT'S
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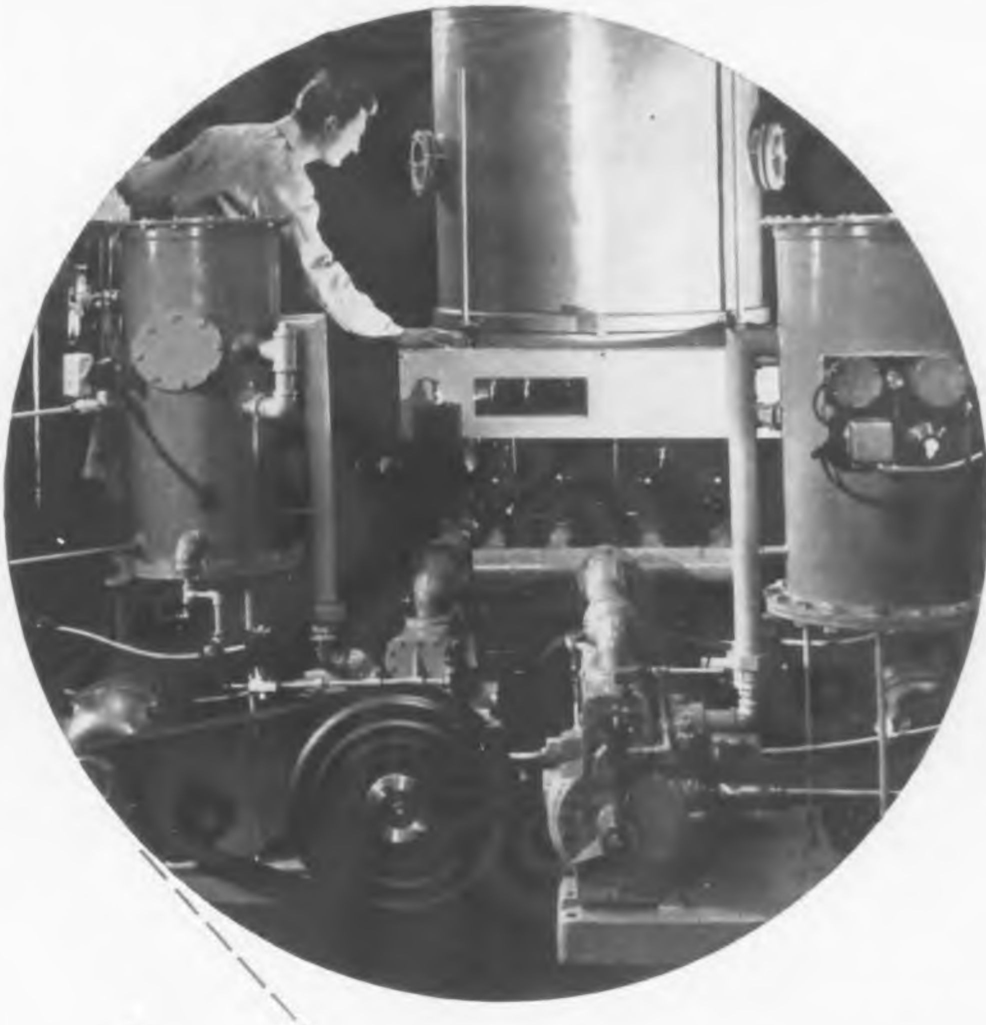

LOOK INTO THE WONDER WORLD OF **VACUUM**

Even though they say nature abhors a vacuum, industry goes for it and in a big way! Vacuum processing with the aid of Kinney High Vacuum Pumps is one of the big wonder workers of industry today.

For example, take this compact vacuum coating system, made by Distillation Products Industries. In such equipment as this are produced many of the items created by today's leading industrial designers: Auto horn buttons, lenses, refrigerator name plates, decorative novelties, costume jewelry, toys, and many other non-metallic products which depend on a micro-thin film of metal for their eye-appeal and utility. Kinney High Vacuum Pumps are used for speedy evacuation of the vaporizing chamber and for backing diffusion pumps during the metalizing operation.

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Conductors: Multiple—2 to 7 or more conductors of stranded tinned copper. Insulation: extruded color-coded plastic. Closely braided tinned copper shield. Tough, durable jacket overall.

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for VHF and UHF, AM, FM and TV high frequency circuits. LENZ Low-Loss RF wire, solid or stranded tinned copper conductors, braided, with color-coded insulation, waxed impregnation.

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Conductors: Extra-flexible tinned copper. Polythene insulation. Shield: #36 tinned copper, closely braided, with tough durable jacket overall. Capacity per foot: 29MMF.

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TINNED COPPER SHIELDING AND BONDING BRAIDS
Construction: #34 tinned copper braid, flattened to various widths. Bonding Braids conforming to Federal Spec. QQ-B-575 or Air Force Spec. 94-40229.

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Conductors: Multiple—2 to 7 or more of flexible tinned copper. Insulation: extruded color-coded plastic. Cable concentrically formed. Closely braided tinned copper shield plus brown overall cotton braid.

PA AND INTERCOMMUNICATION CABLE
Conductors: #22 stranded tinned copper. Insulation: textile or plastic insulated conductors. Cable formed of Twisted Pairs, color-coded. Cotton braid or plastic jacket overall. Furnished in 2, 5, 7, 13 and 25 paired, or to specific requirements.

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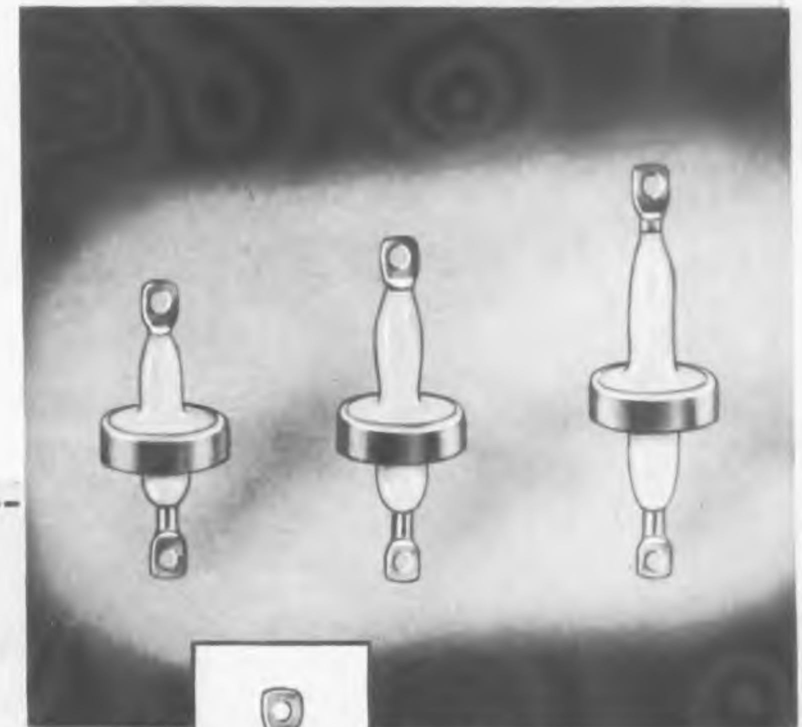
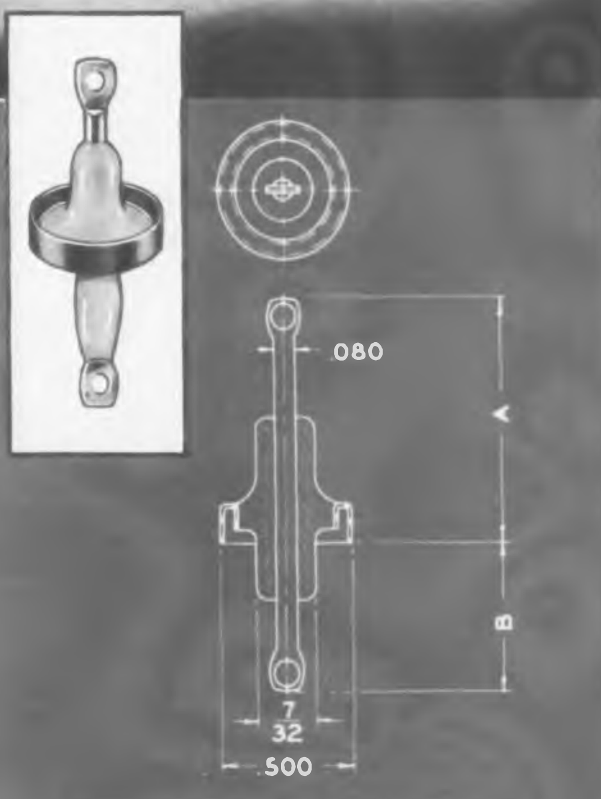
TAKES UP TO 10,000 VOLTS TEST

New

HIGH VOLTAGE TERMINAL



RUGGED FOOLPROOF



PART NO	A	B	TEST VOLT
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1533-75	7/8	23/32	7500
1533-100	1.0	29/32	10000

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Write for your FREE copy of HERMETIC's informative new 32-page brochure, the most complete presentation ever offered on hermetic seals.

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• DIRECT READING • RAPID CYCLING • LOW COST

PRINTED READOUT for high speed electronic counters is now available at low cost as a standard BERKELEY product! This Digital Recorder provides a direct means of permanently recording sequential count information in arabic numeral form on a standard adding machine tape. It is designed to operate from electronic counters, Time Interval Meters, Events-per-Unit-Time Meters, nuclear scalers, and other electronic totalizing devices. Most standard BERKELEY instruments now in use can be readily adapted for operation with the BERKELEY Series 1550 Digital Recorder, thus eliminating the need for purchase of new counting equipment.

DIGITAL RECORDER . . . Series 1550 is composed of a Readout unit and a Printing Recorder. The first unit consists of a bank of readout decimal counting units essentially paralleling the totalizing function of the basic counting instrument from which they operate, and a selecting relay matrix to channel information from the counting circuit to the Printing Recorder. This second unit presents a sequence of total counts in direct reading digital form on a standard adding machine tape.

A COMPLETE SYSTEM . . . of Electronic Counter and Digital Recorder then consists of three elements: a suitable electronic counting device, Readout unit, and Printing Recorder. The latter two elements comprise the complete Digital Recorder. Under certain conditions a special modification of the system will permit original count information to be channeled directly into the Readout unit, thus eliminating the need for a separate electronic counter.

SPECIFICATIONS . . . Minimum counting period determined by the characteristics of the basic counting instrument. Maximum cycling rate: 1 printout every ¾ second. Indicating capacities 3, 4, 5 or 6 columns. Readout Unit—20¾" x 10½" x 15" cabinet, wt. 60 lbs., standard 19" relay rack panel. Printing Recorder—7½" x 8¼" x 14½" cabinet, wt. 20 lbs. Price, Digital Recorder, Model 1553 (3-column), $1050; Model 1554 (4-column), $1125; Model 1555 (5-column), $1200; Model 1556 (6-column), $1275, f.o.b. factory.

M-2

Please request Bulletin 810

Berkeley Scientific

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"DIRECT READING DIGITAL PRESENTATION OF INFORMATION"

TELE-TIPS

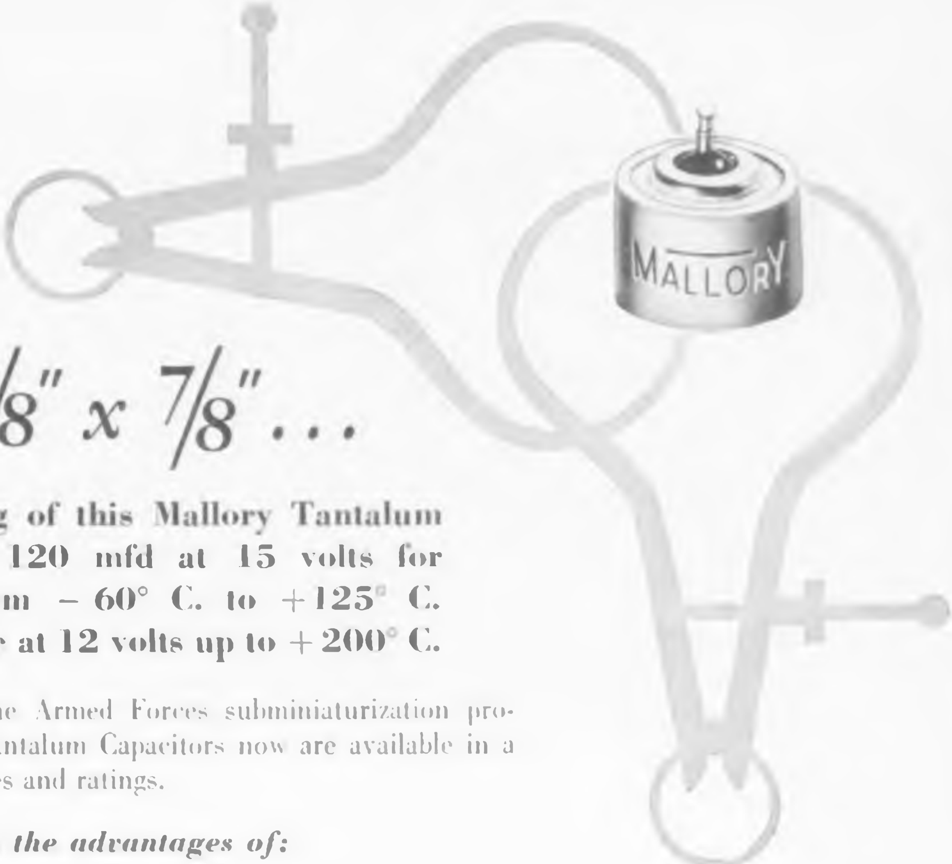
"PREVIEW TV" is the name given a special TV set which, installed in public places operates by a special patented device for a few minutes at the beginning of a program giving a preview of that program without charge, thereupon turning itself off, lighting up a sign which instructs the user to deposit a coin to see the remainder of the program. Large blocks of motels have been signed up for installation of this new TV entertainment device.

WAVE CONTOURS may now be studied by a gage which is submerged deep in the ocean and feeds a sensitive magnetic amplifier which responds to powers of less than 10^{-12} watt. Left alone for days or weeks at a time, the instrument records faithfully the slightest disturbances on the surface. The magnetic amplifier operates by changing very small dc into a variation of ac which is shown on a cathode ray tube to reproduce the contours of the ocean waves.

INDICATIONS are that the size of TV tubes is going to stay up, but that 30 in. will be the largest for home use. After all, cabinets to house picture tubes larger than this will not pass through doorways in the average home! We hear that many tube makers are disposing of their 16 and 17 in. tubes at very low prices. Does this mean that these will soon join the 10-in. tube in the limbo of the past?

WORLD'S LARGEST TRAIN communication system is claimed by the Pennsylvania Railroad. Presently installed over 2000 miles of line from the eastern seaboard to Chicago and St. Louis, the company plans to increase its present $9,000,000 investment and extend the radio-and-wire network over more of its system. Greater efficiency and increased safety result from the rapid communication between crewmen, flagmen and station control operators. Statistical breakdown on units in service: Two-way telephone equipment on 916 locomotives, 230 freight train cabin cars, and 122 wayside towers, as well as 25 walkie-talkies for portable use.

(*Continued on page* 24)



Just 5/8" x 7/8"...

yet the rating of this Mallory Tantalum Capacitor is 120 mfd at 15 volts for operation from − 60° C. to +125° C. It will operate at 12 volts up to +200° C.

Developed for the Armed Forces subminiaturization program, Mallory Tantalum Capacitors now are available in a wide range of sizes and ratings.

They offer you the advantages of:

Compactness

Continuous performance over a temperature range of −60° C. to +200° C.

High resistance to shock and vibration

Proof against thermal shock from −60° C. to +200° C. without damage

Double sealing for absolute protection under all operating conditions

Now that Mallory Tantalum Capacitors are available in quantity, check their advantages for your equipment. Don't hesitate to consult Mallory on any problem involving the application of capacitors, the development of special types or the simplification of related circuits.

Get complete information...

Write for your copy of the Technical Information Bulletin on the Mallory Tantalum Capacitor. It is complete with sizes, mounting arrangements, surge voltages and performance curves.

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MALLORY

SERVING INDUSTRY WITH THESE PRODUCTS:

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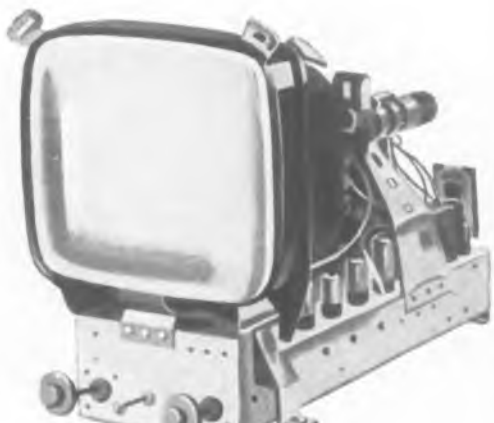
FOR RADIO  AND

 TV SOLDERING THAT LASTS...

USE... 

For any soldering job that demands freedom from corrosion and conductive flux residue . . . for ease of working and unequalled consistency . . . there is nothing better than Federated Rosin Core Solder.

Each Rosin Core Solder composition, of which there is a variety for different purposes, is a tin and lead alloy with a rosin flux that is effective but not corrosive. Because the rosin residue is chemically inactive, current leakage at radio and television frequencies is prevented.

Federated Rosin Core Solder is a quality product that is unsurpassed for the permanence of the bond it produces . . . for the consistently easier soldering job it does! Look for it in 1. 5, 20, 25. and 50-pound sizes on the familiar orange and black metal spool. Listed by Underwriters' Laboratories Inc.

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ACTUAL SIZE

FOR

- **guided missiles**
- **telemetering**
- **recorder amplifiers**
- **and all audio frequency amplifiers critical for microphonics**

MICROPHONIC NOISE OUTPUT — NOT MORE THAN 2.5 MILLIVOLTS across plate resistor of 10,000 ohms with applied vibrational acceleration of 15 G at 40 cycles per second.

- **AMPLIFICATION FACTOR** **60**
- **MUTUAL CONDUCTANCE** .... **2500 umhos**
- **HEATER** .... **6.3 volts, 200 ma.**

*The low microphonics result from Raytheon's advanced design — *not from tube selection.*

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RAYTHEON MANUFACTURING COMPANY

RAYTHEON MAKES ALL THESE

to the E. E. *or* PHYSICS GRADUATE

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RADAR OR ELECTRONICS

Hughes Research and Development Laboratories,
one of the nation's large electronics organizations, is now
creating a number of new openings
in an important phase of its operation.

Here is what one of these positions offers you:

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Hughes Research and Development Laboratories is located in Southern California. We are presently engaged in the development of advanced radar devices, electronic computers and guided missiles.

2. THE NEW OPENINGS

The positions are for men who will serve as technical advisors to the companies and government agencies purchasing Hughes equipment. Your specific job would be to help insure the successful operation of our equipment in the field.

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Upon joining our organization, you will work in our Laboratories for several months until you are thoroughly familiar with the equipment you will later help the Services to understand and properly employ.

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After your period of training (at full pay), you may (1) remain with the company Laboratories in Southern California in an instruction or administrative capacity, (2) become the Hughes representative at a company where our equipment is being installed, or (3) be the Hughes representative at a military base in this country—or overseas (single men only). Compensation is made for traveling and for moving household effects, and married men keep their families with them at all times.

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You will gain all-around experience that will increase your value to the company as it further expands in the field of electronics. The next few years are certain to see a large-scale commercial employment of electronic systems—and your training in the most advanced electronic techniques now will qualify you for even more important positions then.

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If you are under thirty-five years of age, and if you have an E. E. or Physics degree, with some experience in radar or electronics,

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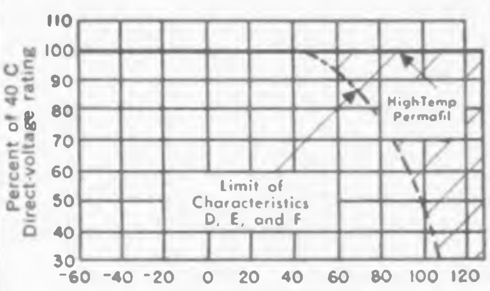
Assurance is required that relocation of the applicant will not cause disruption of an urgent military project.

Reduce space and weight requirements as much as 80%...

G-E Permafil d-c capacitors designed to operate in high ambients—up to 125 C—without derating

Why you gain by using Permafil capacitors for high-temperature operation



Comparison of operating voltages for JAN-C-25 characteristics D (vegetable oil), E (mineral oil), and F (synthetic insulating liquids) with Permafil impregnated capacitors—crosshatched area reveals advantages of Permafil over other impregnants in the high-temperature range above 40 C.

For ambient temperatures above 40 C, most liquid-filled paper-dielectric capacitors require considerable derating. This increases both space and weight requirements.

G-E Permafil capacitors, however, operate in high ambients—*up to 125 C*—for 10,000 hours, at full rated voltage. They average about 1/5 the size and weight of liquid-filled capacitors that will operate at 125 C—a saving of 80%. They're suitable for all blocking, by-pass, filtering, and many coupling and timing applications.

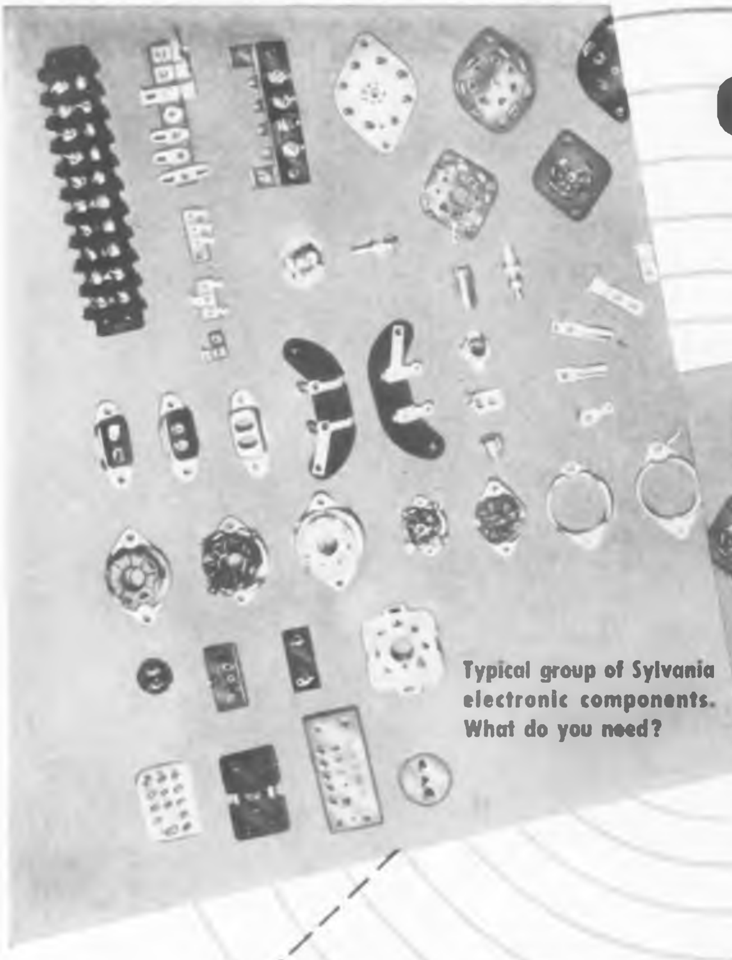
Permafil capacitors stand up in elevated temperatures because the paper dielectric is impregnated with a ***solid*** plastic compound that retains its electrical stability at ***both*** high and low temperatures. And since the impregnant is a solid, it can't leak. With proper derating or where short life characteristics are permissible, Permafil capacitors can be used in temperatures as high as 150 C. They can also be used in high altitudes and where extreme cold is encountered. Other characteristics include high insulation resistance and comparatively constant capacitance with temperature changes.

G-E Permafil capacitors can be obtained in case styles CP53 and CP61, as covered by specification JAN-C-25—in ratings of .05 to 1.0 muf, 400 volts DC. They are housed in metallic containers and hermetically sealed with G-E long-life all-silicone bushings.

For full information on Permafil capacitors, see your local G-E representative. Or write Section 407-310. Ask for Bulletin GEC-811. *General Electric Company, Schenectady 5, New York.*

GENERAL ELECTRIC

407-310



Typical group of Sylvania electronic components. What do you need?

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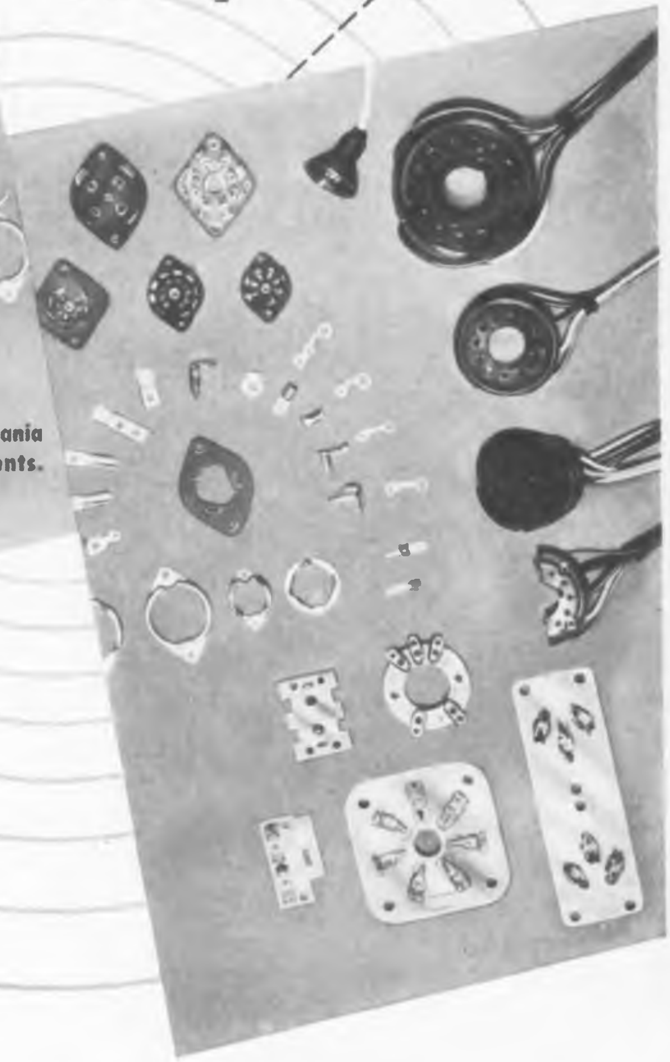

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Sylvania provides highest quality electronic components for radio, television and other electronic equipment . . . at lowest prices.

New plant facilities and improved methods now enable Sylvania to provide you with highest quality electronic components for every need . . . *when you need them.*

Typical examples of Sylvania components include hundreds of diversified items such as: *Terminal Strips and Boards; JAN Sockets; Radio Tube, Cathode Ray Tube and Power Tube Sockets; Fuse Holders; Plugs and Connectors.*

To be sure of the finest possible quality . . . put your component problems up to Sylvania. We welcome your inquiries addressed to: Sylvania Electric Products Inc., Dept. A-1111, Warren, Pa.

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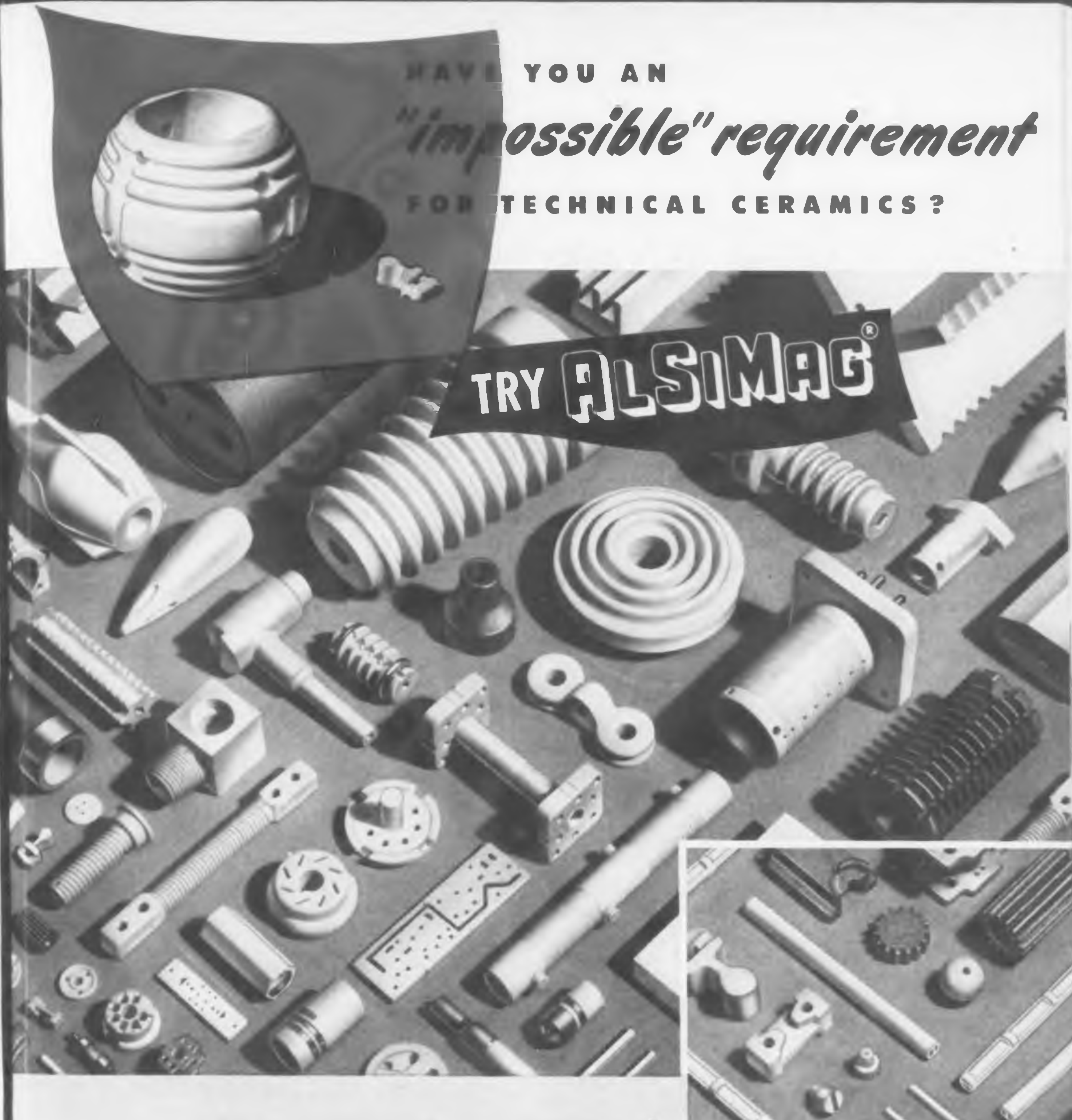
HAVE YOU AN

"impossible" requirement

FOR TECHNICAL CERAMICS?



These parts are enlarged approximately one and one half times.

Many people are kind enough to say we're the first to try for any "impossible" technical ceramic. It's probably true that we've made more different sizes, types and shapes than anybody.

Through cooperation, and a little give and take on both sides, we've been able to make a lot of "impossible" ceramics. If you have an "impossible" requirement, let us know. We might be able to work it out with you. Anyway, we'd be caught trying.

We don't make a thing but technical ceramics. We've been doing it for over fifty years. It might pay you to give us first crack at anything in technical ceramics.

P. S. A couple of new plants in production now! On most things we can give you pretty fast deliveries.

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TELE-TIPS

(*Continued from page 16*)

GERMANIUM, wonder metal of the 4-year-old transistor, was first predicted by the Russian chemist Dmitri Mendeleff, in 1871, who described its probable properties while compiling his famous "periodic table of the elements,"—although he never lived to see the actual metal. Fifteen years later, Clemens Winkler, a German, actually discovered a piece and named it for the Latin designation of his native land. Then nothing much happened for 62 years, until the telephone people discovered that germanium worked like the cat-whiskers in early crystal sets, except a whole lot better. Most germanium is found in chimneys as a waste from the smeltering of lead, titanium, and zinc. The Eagle-Picher Co., which didn't realize for years what precious stuff was going up its flues, is the leading producer of germanium in the U.S.

UNDERWATER SOUND EQUIPMENT is receiving accentuated attention. The Navy reports that the number of West Coast manufacturers producing these equipments has doubled within the last year. At the Navy Electronics Laboratory on Point Loma, San Diego, Cal., a multi-million dollar annual research and development program is being carried out by a staff of over 1000 scientists, engineers, and technicians. The success of its program depends greatly upon the ability and willingness of West Coast manufacturers of electronic equipments to produce development models and equipments from NEL designs as required by the Navy's materiel Bureaus.

"ELECTRONIC COP"—a simple radar-like device that sends out a beam of 5-in. radio waves and picks up their echoes from moving objects, is being used to detect automobiles, as well as pedestrians, approaching the main entrance of the General Electric Research Laboratory at Schenectady, N.Y. Approach of a car causes a bell to ring, warning a guard whose attention may have been temporarily diverted, as by a telephone call. A person walking is detected at about 100 ft., an automobile produces an effect several hundred feet away. Though the system differs from radar used to reveal the presence of ships and airplanes, mainly in the fact that its waves are sent out continually rather than in brief pulses, it does embody principles used in the wartime proximity fuse. The vehicle-approach alarm system was developed by William C. White, C. Luther Andrews and Hiram S. Lasher of the Laboratory. The system sends out radio waves which are only 5 in. long and behave much like light waves. Some of these waves may be echoed back to the transmitter by an object in the beam. If the object is stationary nothing happens. But if it is moving, the returning waves successively go in and out of step with those being sent out, causing the alarm to operate.

TINY CAPACITOR—At the recent Manchester, England, radio-TV exhibition among the components shown was what the British claimed to be the smallest capacitor in the world. This is 1/16 in. in diameter and is wound round with paper on which there is a metal coating a millionth of a millimeter thick—a dimension which can only be measured by electrical resistance or by light.

PITY THE POOR SCOTS who have a television station but can't see TV in the town alongside the station! It seems that there is no electric power in Shott 'O Kirk in Scotland where the Scottish TV transmitter is located. Perhaps there's a fortune for someone who can make a good cheap battery-operated TV set for export— or for portable domestic use!

THE WHITE HOUSE, as reconstructed, is now completely protected against lightning, using half-inch lightning conductor cable leading to half-inch copper ground rods 10 ft. long. The George E. Thompson Co., Minneapolis, Minn., which made the installation, recommends that all radio and TV antennas be provided with arresters grounded through similar heavy conductors, as was done for the White House. Since 1885 the Federal Government has been protecting its buildings from lightning. That year an installation was made on the Washington Monument after it had been struck twice.

SALESMAN'S PRAYER—"O Lord, help me to Remember that Humility is still the Hallmark of the Successful Salesman—that the Seller is Always Servant to the Buyer—that Arrogance Costs as many orders as Ignorance of the Line—that I have Too Short a Memory ever to Tell a Lie—and that the Buyer has Too Long a Memory ever to Forget a Wrong!"—Posted in waiting room outside the office of A. J. Schmitt, president of the multi-million dollar American Phenolic Corp., Chicago.

high heat resistance...
low loss...

Designed for extreme heat conditions, such as are encountered in modern aircraft, Teflon dielectric performs satisfactorily in temperatures as high as 500° F. Use of Teflon as dielectric in RF cables is an outstanding achievement of the skilled research team at Amphenol.

In addition to the important feature of high heat resistance, Teflon has electrical characteristics which exceed those of Polyethylene. Teflon is the *one* satisfactory cable for use, not only in aircraft, jet engines or guided missiles, but in covered electronic equipment or any application where temperatures might run over 185° F.

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POLYTETRAFLUOROETHYLENE

for insulation in
cables & connectors

Expert engineering, highest quality materials and stringent continuous inspection make Amphenol cables the very best that can be had *anywhere!* Uniform quality and maximum performance from every foot of Amphenol cable is assured by constant checking and testing. Every shipment of cable is accompanied by a notarized affidavit certifying the guaranteed construction of the cable.

Amphenol also manufactures a comprehensive line of RF Connectors with Teflon inserts for high voltage or extreme heat applications.

Write for this free literature describing Amphenol Teflon cable. Address Dept. 13D

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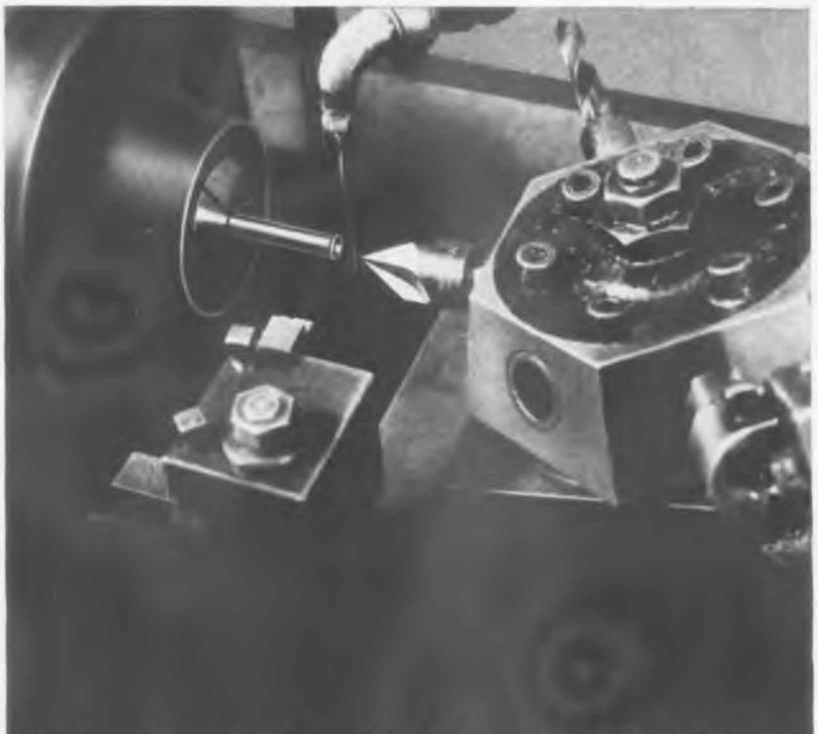

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to give you the parts you need

Need a tubular part machined, inside or out, at one or both ends? Like to have it drilled transversely at one or several points? Want it to meet rigid dimensional and metallurgical specifications? You're reading the right advertisement for all of these are Superior Specialties.

Superior has the experienced men, the specialized, highly developed equipment, the floor space, and the research facilities to produce quantities of drilled and machined tubular parts rapidly and economically.

It's a job we like to do and know how to do. But there's more to the story than simple production of fabricated or semi-finished parts, or even top-quality tubing in any analysis and many sizes.

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If you are a manufacturer or an experimenter in electronics and have a need for a tubular part of any kind, check with us. Write Superior Tube Company, 2508 Germantown Ave., Norristown, Pennsylvania.

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Expanded. Here is a part almost ready for delivery. Simple as it looks, it may well have been the subject of a score of operations and at every stage the prime consideration has been the *quality* of the finished part.

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Phenolite postformed expansion joint cover.

The problem:

to insulate a 5 kilovolt, 1500 ampere bus bar installation

Recently I-T-E Circuit Breaker Company of Philadelphia had the problem of *completely* insulating 5 kilovolt, 1500 ampere 3 phase bus bar units for an Atomic Energy Commission installation. It was simple enough to insulate the bus bars with oval Phenolite tubing. But, to completely insulate the bus supports and expansion joints was a real problem. I-T-E's engineers showed us what they wanted . . . postformed Phenolite insulating covers . . . drawn deeper than anything we had ever attempted. Our engineers tackled the problem.

Expansion joint with and without Phenolite insulating covers

The solution:

Phenolite Grade X-114A postforming material and National's technical "know how" in the design of forming dies

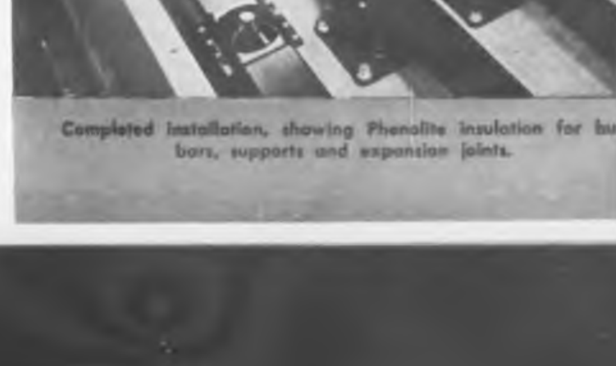
Perhaps *your* problem doesn't involve the insulation of 5 KV, 1500 ampere bus bars. But maybe you have an insulating problem where National can give you some real help in solving how to do your certain job economically. Write us, our engineering service is immediately available.

Bus support with and without Phenolite insulating covers.

National Laminated Plastics
nationally known—nationally accepted

PHENOLITE Laminated PLASTIC

The perfect insulation material for high and low voltage applications, Phenolite possesses an unusual combination of properties. It has great mechanical strength and high resistance to moisture; ready machinability; is about one-half the weight of aluminum. Standard colors are natural, black, chocolate; mirror, semi-gloss and dull finishes. Sheets, Rods, Tubes, Special Shapes.



Completed installation, showing Phenolite insulation for bus bars, supports and expansion joints.

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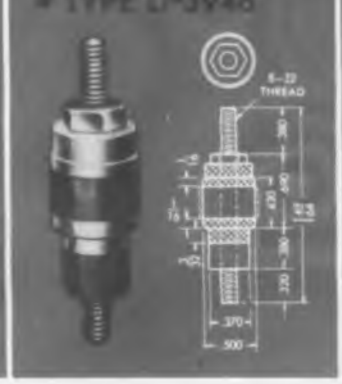
- PERMANENT SEALING
- RESISTANCE TO HEAT
- EXTREMELY LOW-LOSS

• TYPE D-3405

• TYPE D-3540

• TYPE D-3946



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• SOLDER LUG TYPES

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B	.490	5/8	15/16	3/4
C	3/8	.490	11/16	9/16
D	.095	.095	.130	.130
E	3/16	1/4	3/8	1/4
F	3/16	3/8	3/8	5/16
G	1/2	7/8	1 15/32	2 7/16
H	1/16	3/32	1/8	1/8
J	3/32	1/8	1/8	1/8

• THREADED STUD TYPES

PART NO.	D-3856	D-3857	D-3962	D-3638
A	1 7/32	1 51/64	2 15/32	2 15/32
B	.490	5/8	15/16	15/16
C	3/8	.490	11/16	11/16
D	1/16	1/16	.055	1/16
E	1/4	1/4	3/8	3/8
F	3/16	3/8	3/8	3/8
G	1/2	7/8	1 15/32	1 15/32
H	1/16	3/32	1/8	1/8
J	3/32	1/8	1/8	1/8
K	6-32	6-32	8-32	10-32

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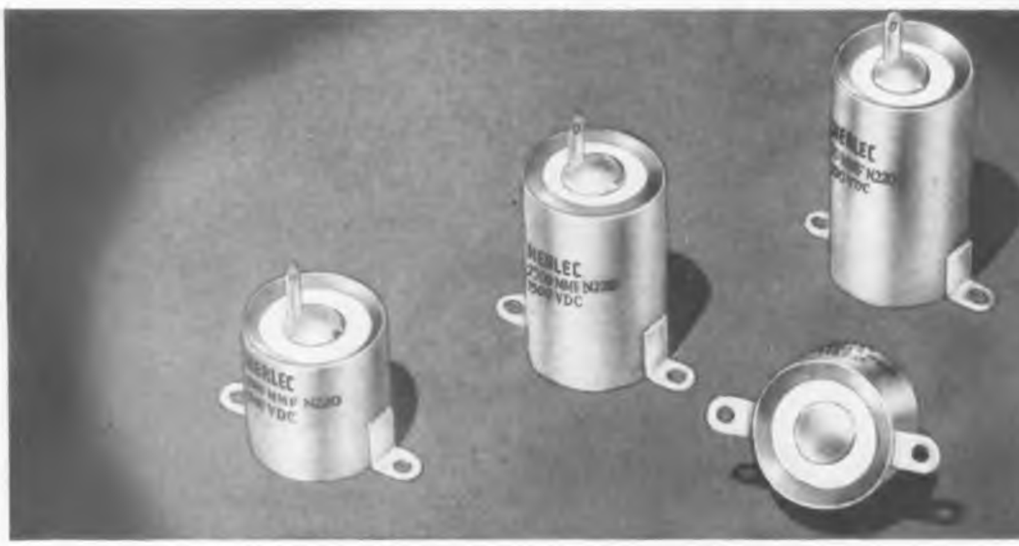
20,000-Volt Molded Ceramic Capacitors

Molded in moisture resistant, non-flammable thermosetting plastic, these new Sprague Type 700C Ceramic Capacitors offer exceptional reliability and economy as filters for TV receivers and C-R instrument high-voltage supplies. Standard capacitance is 500 mmf. and the units are conservatively rated for operation at 20,000 volts d-c. Write on letterhead for Engineering Bulletin 606.



Extended Capacitance Ranges for Precision Circuitry

These new Sprague-Herlec Precision Tubular Ceramic Capacitors make it possible to control the capacitance tolerance of exacting 500, 1000 and 1500 V. d-c precision circuits within ±1%. Temperature coefficient tolerances may be reduced to as little as ±10 parts in a million!

A logical development of the design first popularized in Sprague-Herlec cup ceramics, they greatly extend the capacitance range available to designers. "Q" and capacitance stability are high and the units have excellent retrace characteristics. Hermetically sealed in metal tubes, they operate over the range from −55°C. to +85°C. Bulletin 607 sent on letterhead request to Sprague Electric Company, 233 Marshall St., North Adams, Mass. or to the wholly owned Sprague subsidiary, The Herlec Corp., 422 N. 5th St., Milwaukee 3, Wis.

SPRAGUE®

WORLD'S LARGEST CAPACITOR MANUFACTURER

TELE-TECH

& ELECTRONIC INDUSTRIES—RADIO-TELEVISION

O. H. CALDWELL, Editorial Director ★ M. CLEMENTS, Publisher ★ 480 Lexington Ave., New York (17) N. Y.

Engineers Must Learn How to Sell —

Both Themselves and Engineering Ideas!

Engineers are a modest lot. We are prone to let our work speak for itself without realizing that, by the time it speaks in a language that is readily understood, the authorship may have been forgotten. There is little wonder that the major credit often rebounds to the producer or the seller rather than to the creator of a new product. Far too often success is not achieved and excellent conceptions are never fully developed because we have failed to recognize the need to sell the idea itself, its potential for good, or the research necessary to apply it.

Far too generally accepted in the profession is the idea that selling is something for which one has to be specifically suited, and that selling is somehow incompatible with engineering. Selling is a universal human tool wherever man deals with man. From the time we are born, we are constantly engaged in selling. A baby's cry in the night is his way of selling the idea that it is time for feeding, and if you don't buy the idea, you don't sleep. This may be an effective way for an infant to sell his needs, but considerable more maturity is required as our social contacts become more complex.

Emotional Maturity Needed

It is not unreasonable to expect engineers to develop an emotional maturity equal to that of anyone engaged in selling as a profession. I am afraid it is our failure to recognize this that often makes us poor salesmen, rather than our inability to present facts in a logical manner. What we have to present can be scientifically unimpeachable, but unless it is understood, our efforts will be ineffective. We need, therefore, to develop an understanding of the other fellow and an ingenuity of presentation which will help him to understand our goal and share our desire to see such goals achieved.

To be honest we have to admit that one of our greatest failings as engineers has been our propensity to examine the details, leaving far too little time to be broadly objective in our planning. If, in addition to the time spent in solving our immediate problems, we would find time to show more enthusiasm for the ultimate objectives, there should be an enhancement of both the economic and social standing of our profession.

Selling is communication, and this is where engineers in the past have been lamentably weak: we have mastered the *science* but not the *art* of communication.

Tune To the Other Fellow's Wavelength

When, on the other hand, an engineer does have the ability to communicate his ideas to others clearly, he becomes a marked man. I saw a striking example of this not so long ago. It was at an important management meeting in which an engineer was called on to give a progress report to men who, for the most part, had not met this engineer before. In fifteen minutes he told, in a simple way to men who were not engineers, what he was doing, with such clarity and conviction that he at once became a man marked for a future. He had something to sell and he sold it. To do this he first had to be able to put himself in the place of his audience in order to appreciate its interest and point of view, then make his presentation accordingly. *Often we get better results by tuning our transmitter to the other fellow's receiver rather than by assuming he will tune to our wavelength.*

Let me add that retuning our transmitter is not always the easiest job in the world. The wavelengths on which we must transmit are numerous if communication in the true sense is to be established.

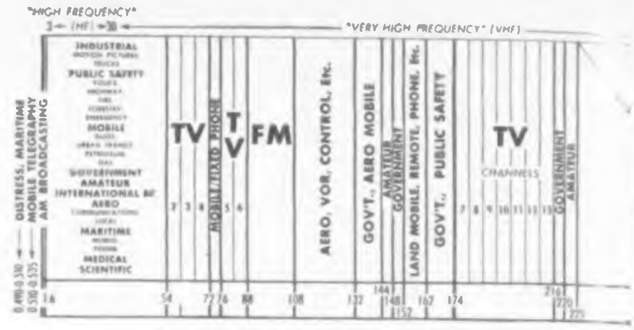
Wider acceptance of engineering philosophy, and a more complete realization of its goals, depend in large measure on salesmanship of the right kind.

Engineering has something to sell; let's sell it!

A guest editorial by E. Finley Carter, Vice-president Sylvania Electric Products, Inc., New York, abstracted from his remarks before the Western Convention, IRE, Long Beach, Calif., with the hearty concurrence of the Editors of TELE-TECH.

RADARSCOPE

Revealing Important Advances Throughout the Spectrum of Radio, TV and Tele Communications



MILITARY PROCUREMENT

SIGNAL CORPS PROCUREMENT REORGANIZED—Signal Corps Supply Agency, Philadelphia, has reorganized its procurement setup, effective now, reflecting changes in requirements and progress in equipment production. A major change was the elimination of the "Contract Division" and establishment of an Awards Division and a Production Division. The Awards Division takes over former Contract Division responsibilities; the Production Division is designed to expedite and monitor production and delivery of equipment now being manufactured. The new organization also transfers administration of all contractual matters to the Signal Corps regional offices in New York, Chicago, Los Angeles and Ft. Monmouth, New Jersey. This is a major procurement reorganization affecting Signal Corps procurement of electronics, as well as other items. Reorganization chart and details are given on a following page.

NEW HORIZON

SUPERCOLD TECHNOLOGY—Already industry is shipping liquid oxygen (—297°F.) in tank cars, and new supercold techniques are finding everyday uses. In communications, a potential possibility is the use of refrigerated crystals to pick up radio signals too faint to be detected by a heated tube. This possibility is suggested by the superconductivity of a number of metals and crystals at extremely low temperatures. When the atoms are either "stopped in their tracks" or their motions ordered to conform with each other, by such low temperatures, internal friction among them is largely eliminated, and current flows easily. Moreover, undesirable electrical signals due to thermal motion of the atoms are suppressed and the crystal is thus more sensitive as a detector. Since communication and control processes usually involve low energy levels, elimination of thermal noise makes possible more delicate measurements and detection. The radio industry is already acquainted with some of the benefits of low temperatures, through its use of refrigerated traps for achieving a vacuum. Vapors driven out of metal tube elements in the process of manufacture will collect on a cold surface faster than they could be removed by pumping; liquid helium traps may be suitable for rapid evacuation during the production of high-performance tubes.

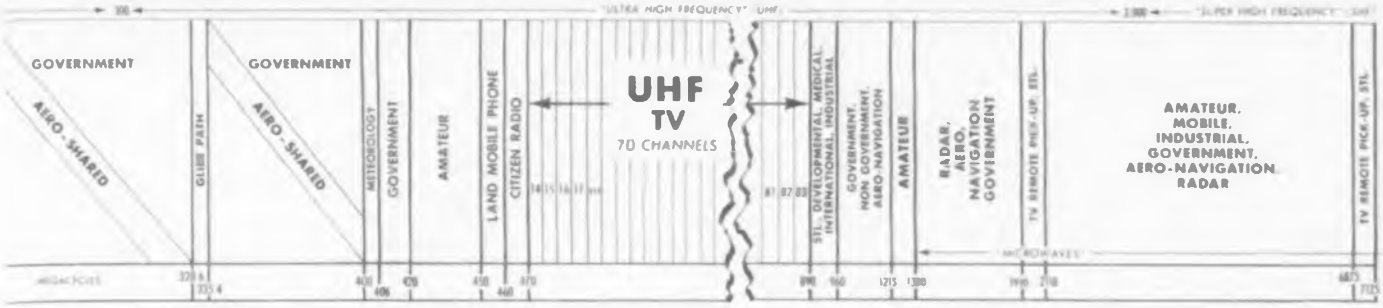
New automatic telephone recorder offered by Bell System operates from 110 volt ac supply, and costs $15 for installation plus $12.50/month. In operation, subscriber makes one-minute "talk out" record on magnetic drum. In subscriber's absence announcement is played to caller, after which a 28-second period is provided for the caller to leave a message. Recording drum can accommodate 20 consecutive messages. Beep tone is sounded at the start and disconnect finish of the 28-second period. Since equipment is attached directly to the telephone line, receiver is not taken off hook during exchange of messages

SUPPLIES

STEEL MAKING FACILITIES added to the capacity of the country's steel making plants during 1951 can make enough steel for 1,000,000 television sets, 1,000,000 autos, 800,000 refrigerators, 10,000 freight cars, 1 aircraft carrier, two heavy cruisers, 500 tanks, 3000 six-room houses, 10,000 aircraft, and 500,000 half-inch steel shelves. Even after making all these things 6000 tons will be left over. Reading figures like this makes us wonder why TV and Radio steel allocations have to be cut down. It makes us wonder perhaps that some of the cut-backs in Radio Electronic production are not more for appearances sake than dictated by necessity.

TV MOTION PICTURES

COOPERATION FEUD! It is interesting to note that while the motion-picture industry is bitterly opposed to the release of recent-vintage feature films for TV broadcast use, (vis-a-vis the current struggle with the government on the release of 16mm stock ordinarily for use by armed forces, churches, hospitals and schools), yet continually declining box-office receipts have led to an arrangement between the movie and the radio-TV industries whereby each will plug the other's wares. Radio and television broadcasts include daily listings of current motion pictures as well as movie-personality shorts and interviews. The theaters boost TV programs in film trailers, and mention radio-TV's part in their regular program mailings and posters.



TELEVISION X-RAYS

SCANNING X-RAY SYSTEM developed by Prof. R. J. Moon of the University of Chicago is capable of producing an image which will show the wrinkles in the skin of a finger, as well as outline the bone structure. Scanning arrangement permits exposure to 0.01% of amount of X-rays required by standard apparatus for equivalent picture. The device's suitability for photographic recording of moving objects suggests studies of high-speed mechanical equipment. Operation of the tube at 53,000 v., 30 to 50 ma, depends on an electron beam from a TV-type scanning gun striking a tungsten target which emits X-rays. These rays pass out of the tube through a small hole in a metal shield, through the object being examined, and on to a crystal of calcium fluoride. The crystal in turn transforms the X-ray pattern into a pattern of bursts of ultraviolet rays which are picked up by a photomultiplier tube. The amplified impulses go to a picture tube, enlarging the image.

MANPOWER

ENGINEER SHORTAGE will get worse next year, warns ex-President Herbert Hoover, himself a distinguished engineer who did much to guide radio development in the 1921-1929 period. "We do not have enough engineers in incubation to carry on the nation's work," says he. "We need 60,000 new technologists a year to supply national needs. Our engineering graduates have dropped from 50,000 in 1950 to 38,000 in 1951. And the students in training indicate less than 30,000 next year." Mr. Hoover adds that one reason for the drop is that a young mechanic with three years of training, during which he is paid, can earn more take-home pay after taxes than a young engineer with six years of training and three years more of experience.

RADAR

RADIO INTERFERENCE aboard Navy vessels is caused by radar systems 56.3% of the time, according to engineering reports covering the investigation of 217 interference complaints. The next two major offenders are radio transmitters, 15.6%, and motor-generator sets for radio equipment, 11.5%. Statistically broken down another way, 88.5% of the complaints are attributed to radio and electronic sources, 10.1% to electrical equipment, and 1.4% to interior communications. Suggested methods for reducing the interference to radio reception are: 1) Utilize shielding offered by bulkheads by using separate wireways for electronic and electrical equipment; 2) Isolate high level and low level leads; 3) Orient antennas for minimum coupling; 4) Shield antenna lead-ins; 5) Replace dc motors with ac motors where possible.

COMPUTERS

MAN BEATS MACHINE! And it's a good thing too, considering the almost human qualities being attributed to electronic computers. Winner and still champion is Electronic Computer Corp. prexy Dr. Samuel Lubkin. Runner-up is Dr. Lubkin's non-sentient brainchild, the 240-tube digital computer Elecom 100. The contest centered on a game of Nim, which requires several piles of marbles. Each player must remove one or more marbles from one pile only. The player who picks the last marble off the table wins the game. Explains the victor, "The machine removes the number of marbles which leaves a combination placing it in a winning position. Once it achieves this position, it can't lose. But the machine doesn't think. It just does as it was told, and since I know what it will do, I don't let it get in a winning position." With due respect to Dr. Lubkin's victory, it should be noted that one of TELE-TECH's editors, as well as several other engineers, succumbed to the "brainless" machine in the contest of Nim.

Engineers designing new UHF television installations are showing increasing interest in the use of waveguide for transmission purposes. Experimental test set-up at Allen B. DuMont Labs. shows standard 5.75 x 11.5 in. guide with two right-angle bends which do not affect line's operation. Favorable comparison with slightly less expensive coax points up the following: 1) Extremely low attenuation of 0.05 to 0.1 db/100 ft., 2) excellent vswr of about 1.01, 3) no reflections from faulty center conductor, and 4) no spurious modes above 750 MC

Microwave Devices

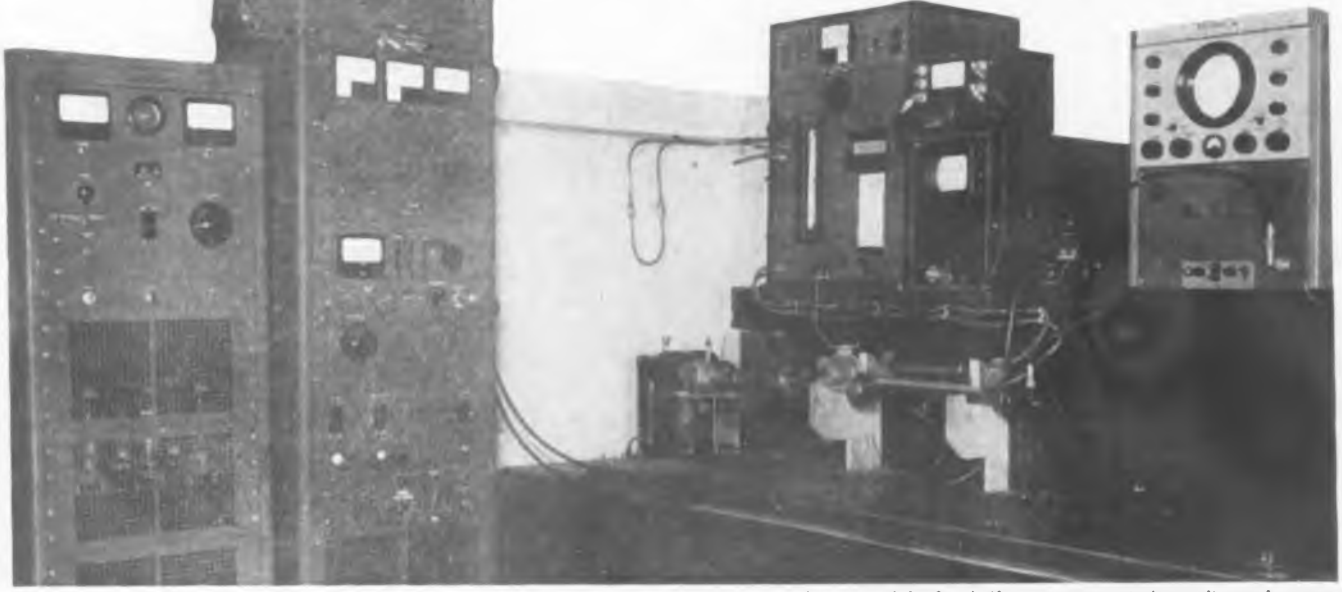


Fig. 1: Standard Amperex magnetron test station. Power supply, control and metering racks are at left. On shelf are power metering unit, synchroscope, r-f monitor and spectrum analyzer. Mounted above bench are magnetron under test, waveguide components, slotted section, wavemeter, and water load

By MARKUS NOWOGRODZKI,
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THE quantity testing of magnetron oscillators frequently presents special problems in microwave instrumentation. Commercially available instruments designed for laboratory-type measurements at microwave frequencies are, in many cases, not suitable for speedy and economical operation by semi-skilled personnel and do not always lend themselves to quantity testing procedures. On the other hand, the comparatively high cost of a magnetron tube, even in quantity production, prohibits the lowering of accuracy standards on the production test station and the consequent danger of decreasing the percentage production yield by the unnecessary rejection of salable tubes.

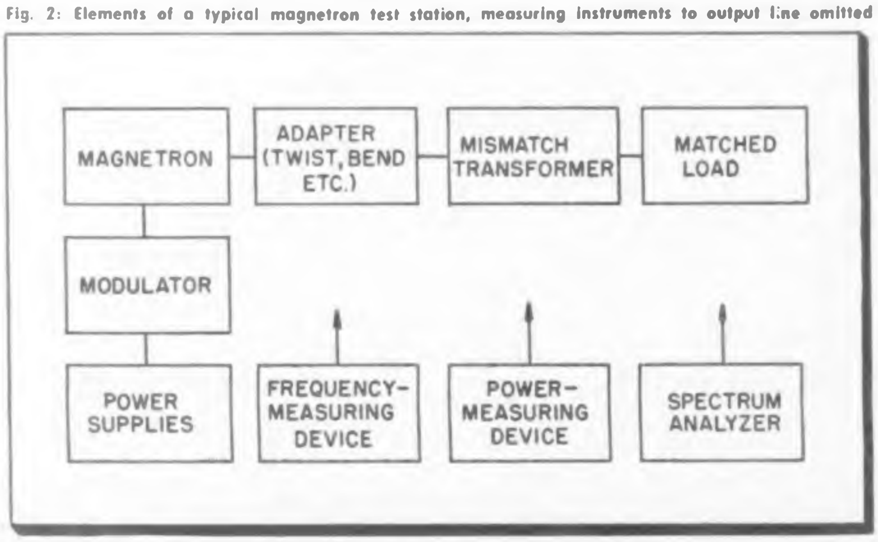
Two qualities of most magnetron oscillators make it possible to simplify the measuring instruments appreciably on the test station without sacrificing the accuracy of results. These are the inherently high power levels generated by the magnetron and the comparatively narrow frequency band which is of interest for most magnetron types. The high power levels propagated along the microwave transmission line on the test station make it possible to employ relatively large quantities of r-f power for measurement purposes without upsetting the accuracy of output-power measurements. The relatively narrow bandwidths encountered in magnetron testing permit, on the other hand, the construction of comparatively simple apparatus designed specifically for a given magnetron test station, without the complications in design and execution arising from the broadbanding attempts usual in laboratory-type instruments.

A photograph of the standard Amperex magnetron test station is shown in Fig. 1. A block diagram showing the elements of a magnetron test station is presented in Fig. 2. The connections of the power- and frequency-measuring instruments to the magnetron output transmission line have purposely been omitted. The interest in this article is focused on microwave devices, i.e., devices designed either to measure magnetron properties in the microwave region of the spectrum or activated by the microwave power output of the magnetron under test.

Visual Indication Wavemeter

A cavity wavemeter, well suited to production measurements of magnetron resonant frequencies, has been developed for the X_B band (6250-6700 MC). Pictured in Fig. 3, it consists of a cylindrical cavity system

Fig. 2: Elements of a typical magnetron test station, measuring instruments to output line omitted



for Magnetron Production Testing

Economical measuring devices take advantage of two magnetron properties: high power and narrow bandwidth. Neon bulb indicator employed in wavemeters and power monitors for X-band and S-band systems

of conventional design placed in the transmission line ahead of the water load and operating as a transmission-type wavemeter. The cavity, designed for operation in the TE_{011} mode, is coupled to a section of RG-50/U waveguide. Instead of the conventional crystal diode and milliammeter combination, a neon bulb is coupled to the output of the wavemeter. As a result, an indicating system without inertia is obtained, so that a flicker of the neon bulb can be observed whenever the cavity is momentarily tuned to the magnetron output frequency as the micrometer head spindle is moved, however rapidly this may be done by the operator. A sketch of the system is shown in Fig. 4.

Principal Advantage

The main advantage of the device, as pointed out above, lies in the fact that it obviates the necessity for slowly "hunting" for resonance by the operator, a drawback of circuits using a meter as an indicating device. Another advantage is the ruggedness of a neon bulb as compared with a crystal diode from the standpoint of burnout, and the low replacement cost of the neon bulb. By tuning the wavemeter for maximum brightness of the neon bulb glow, a frequency measurement accurate to within 1 MC can be obtained, which is adequate for this application. A similar instrument was developed for X-band operation, using RG-52/U waveguide.

R-F Output Sampling

The high power levels generated by the magnetron oscillator can be used to advantage whenever a sample of the energy is required, particularly for injection to the spectrum analyzer. The usual method, which makes use of a directional coupler, appears unnecessarily costly and complicated in test setups utilizing a water load for the matched transmission-line termination. A simple method found adequate in S-band (3000 MC) work is the placement of an N-type connector with an antenna probe extending into the waveguide approximately one-quarter guide wavelength from the water load end plate, as sketched in Fig. 5a. The r-f power extracted in this fashion from the water load certainly does not detract from the accuracy of power measurements when average power levels of the order of 300 watts or more are involved, and the pick-up probe does not disturb the match of the load, whose voltage standing-wave ratio (vswr) remains less than 1.05:1.

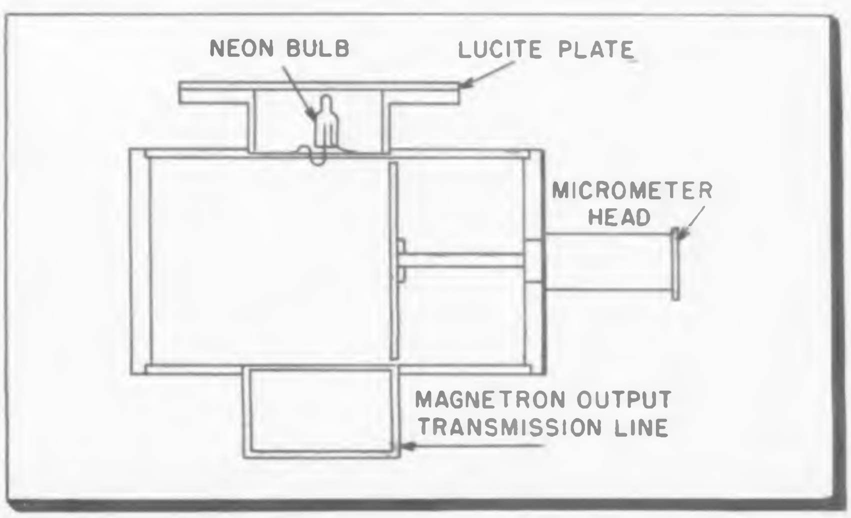
A variation of the method described above is shown in Fig. 5b, where the water-carrying glass tube in the load has been made to extend through the bottom wall of the waveguide, so that a standard waveguide flange could be brazed to the end of the water load section. An attenuating disk is then clamped between this flange and a standard waveguide-to-coaxial transition, the diameter of the coupling hole *d* being used to determine the amount of microwave power available at the output of the transition. This design has been used in the 6300 MC range, and, again, the error in measured power is of the order of 0.5%, while the match of the entire system at the magnetron output terminals is 1.05 : 1 in vswr.

High-Dispersion Wavemeters

For frequency-difference measurements, viz., measurements of magnetron r-f spectrum bandwidth and magnetron pulling figure, wavemeters of comparatively high dispersion may be required. Laboratory instruments of this type are costly and, particularly in the case of longer wavelengths (say, 10 cm), not always readily available. Use can be made, however, of the comparatively narrow frequency band of operation needed, and conventional cavity wavemeters can be designed to operate over a limited range without recourse to complicated mode-sup-

(*Continued on page* 110)

Fig. 3 (l) Visual indication wavemeter. Note neon bulb in center of standard flange. Fig. 4: (r) Sketch of cavity wavemeter with visual indicator



The WJZ-TV Auxiliary

Emergency broadcast antenna atop Empire State Building uses four tor assemblies to obtain good pattern circularity. Skewed arrange-

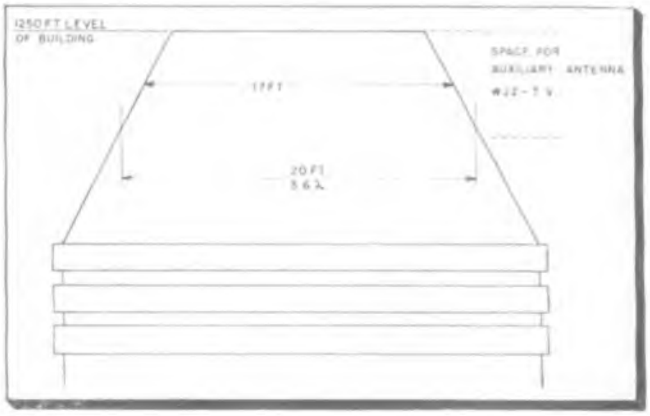


Fig. 1: Top of Empire State Building is frustum of cone

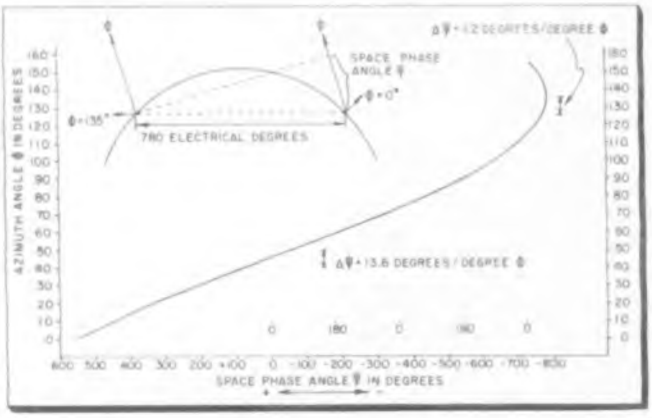


Fig. 2: Plot of computed space phase angle and azimuth angle

By JOHN PRESTON, Director of Engineering Facilities and General Services, American Broadcasting Co., 30 Rockefeller Plaza, New York, N.Y.

THE achievement of a good degree of horizontal pattern circularity from a TV broadcast transmitting antenna is not particularly difficult when the antenna radiating elements can be mounted on or made a part of a supporting structure which is of small cross-section in terms of wavelengths at the operating frequency. For example, a simple turnstile type antenna mounted on a slender supporting pole is capable of producing a horizontal radiation pattern in which the total variation from maximum to minimum does not exceed approximately 3 db. As the support structure cross-section is increased in size, the pattern circularity problem rapidly becomes formidable, particularly if one confines his consideration to the more conventional types of radiating element configurations. To further illustrate, the supporting structure for the WJZ-TV main Empire State antenna is only ½ wavelength in cross-section, and even this small cross-section, we have found recently, poses serious pattern circularity problems. These pattern problems are currently under intensive investigation.

Design Problem

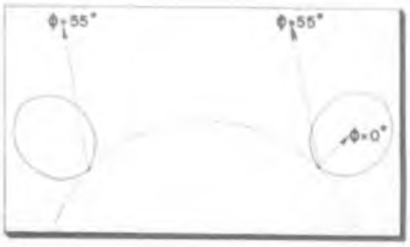
ABC was fortunate in securing rights to erect a permanent auxiliary TV antenna for emergency operation at the very uppermost location on the Empire State Building. We were, however, faced with a vexing antenna design problem from the point of view of horizontal pattern circularity.

Fig. 1 shows the upper part of the Empire State Building—the frustum of the cone—and the space which was available for the WJZ-TV auxiliary antenna. At this location, the building cone is approximately 17 ft. in diameter, slightly over three wavelengths at WJZ's channel 7 operating frequency. The approximate diametric distance between the radiating centers of antenna elements which might be placed around this cone is about 20 ft. or 3.6 wavelengths, as shown on the sketch.

To explore the principles of design of this auxiliary antenna, let us assume that four antenna radiating elements will be uniformly spaced around the periphery of the cone, and that all four elements will be fed electrically in phase.

The more critical factors affecting pattern circularity will now be considered. The sketch on the upper left corner of Fig. 2, a plan view of a sector of the cone, shows the relative position of two of the four radiating elements—at the points marked $\phi = 0$ and $\phi = 135°$. The elements are physically separated by approximately 780 electrical degrees. As the azimuth direction ϕ is varied, the relative lengths of the paths from the widely separated adjacent radiating elements to distant points do not remain equal but rather vary with ϕ. The difference in these path lengths gives rise to a phase angle which we will call space phase angle ψ, as shown on the sketch. The field intensity at a distant point results from the vector combination of the fields from the adjacent radiating elements, which fields differ in phase at the distant point by the amount of the space

Fig. 3: Pattern of radially outward beam



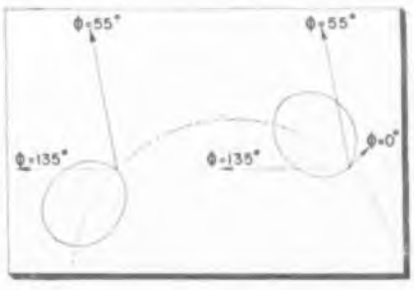


Fig. 4: Skewing element patterns around the supporting structure prevents deep nulls

Antenna

asymmetrical corner reflec-ment prevents deep nulls

Fig. 6: Front view of corner reflector with coaxial dipole minimizing lightning danger

phase angle. The graph on the lower right portion of Fig. 2 is a plot of the computed space phase angle, along the abscissa, against azimuth angle ϕ, along the ordinate.

It may be seen from this curve that the space phase angle varies quite rapidly with azimuth angle through most of the sector from $\phi = 0°$ to $\phi = 135°$. For example, in the vicinity of $\phi = 40°$, the space phase angle is varying approximately 13.6°/ degree of azimuth. The auxiliary abscissa scale indicates the effective magnitude of the space phase angle variation. The phase angle goes through four excursions between 0° and 180° over an azimuth sector of only 70°. This is the villain which has heretofore resulted in severe horizontal pattern nulls. It is only on the nose of this curve, in the vicinity of $\phi = 135°$ that the space phase angle variation is small—about 1.2°/ degree of azimuth.

In practice it is necessary that we let the radiation patterns of adjacent antenna elements overlap, otherwise nulls in the horizontal pattern of the array would result due to absence of any field from either element in some azimuth directions. If the element patterns are beamed radially outward as illustrated in Fig. 3, the pattern overlap will occur in azimuth regions, for example in the vicinity of $\phi = 55°$, where the space phase angle varies rapidly. Severe pattern nulls will of course result from the rapid excursions of the space phase angle between 0° and 180° in such azimuth regions.

The Skew Principle

If the element patterns are skewed around the supporting structure in pinwheel fashion as shown in Fig. 4, the overlap of adjacent patterns can be made to occur in azimuth regions where the space phase angle variation with azimuth is small. In the case illustrated, the pattern overlap occurs in the vicinity of $\phi = 135°$ where space phase variation of only 1.2°/degree of ϕ was found. The large space phase variation in the vicinity of $\phi = 55°$, for example, is now harmless since only one radiating element contributes a significant field in this direction. It is by use of this skew principle that deep nulls in the horizontal pattern of the array can be avoided. It was on this principle that the design of the WJZ-TV auxiliary antenna was based.

The WJZ-TV array now atop Empire State consists of four asymmetrical corner reflector antenna assemblies skewed around the cone as outlined in Fig. 5. The radiating element in each antenna is a coaxial half-wave dipole projecting outward at an angle of approximately 80° from a tangent to the cone. This is referred to as the angle of skew. The asymmetrical corner reflectors serve not only to achieve the required horizontal shape of the skewed individual patterns but also to minimize excessive high angle radiation and thereby increase the horizontal power gain of the array. The elements are driven in phase. Through this design, power gain of unity and horizontal pattern circularity of ± 3 db have been achieved in spite of the three wavelengths diameter of the mounting circle.

Figs. 6 and 7 show front and rear views of one of the corner reflectors and dipole elements. It should be noted that the folded type of coaxial dipole tends to minimize danger of lightning damage to the antenna and feedline insulators.

Development of this array was undertaken through cooperation of the Andrew Corp. and the American Broadcasting Co., and was carried out under supervision of M. W. Scheldorf of the Andrew organization.

Fig. 5: WJZ-TV array consists of four corner reflector assemblies skewed around cone

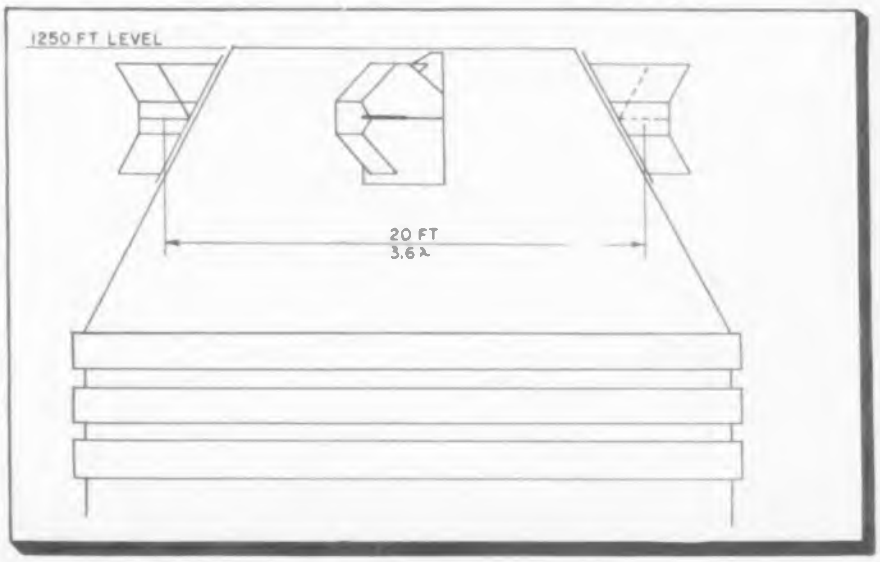


Fig. 7: Rear view of one antenna assembly

Core Materials for Small

Extremely thin strips of new Hipersil reduces weight and losses of transformers for airborne electronic equipment. Special grooving technique increases mechanical rigidity

By C. C. HORSTMAN
Specialty Transformer Dept.
Westinghouse Electric Corp.
Sharon, Penna.

THE demands of the Armed Forces during World War II and since, and especially during the present period of rearmament, have greatly accelerated the improvement of characteristics and reduction in size of small transformers and other iron-cored components. With the rapid advances in the science of electronic equipment, transformer development had to keep pace. This not only involved the development of new magnetic materials, but also new methods of utilization. During World War II there was a great acceleration of the development of high-frequency transformers and of thin-gauge Hipersil cores.[1]

The rapid advances in core material and the increasing strictness of core-material specifications have been based on grain-oriented silicon steel and wound Hipersil cores. The original development of Hipersil[2] was directed toward obtaining a core material with increased permeability and lower hysteresis loss in order to achieve a balanced, economical design of a power or distribution transformer. The permeability was increased at operating inductions by raising the "knee" of the saturation curve. This was achieved by the process of obtaining preferred orientation.

Directions of Magnetization

A single crystal of silicon steel consists of a body-centered, cubic structure. Since it is a cube, there are three possible directions of magnetization: (1) along the cube edge, (2) along the cube-face diagonal, and (3) along the cubic diagonal. The easiest direction of magnetization is along the shortest path, or edge, of the cube, and the aim in orienting the crystal structure is to obtain as many of the cube edges in one direction as possible. Grain orientation is obtained by control of the rolling and heat-treating processes, and, very importantly, maintaining high purity of the silicon steel. The rolling process sets up certain strains in the crystal lattice. By controlling the rolling reductions, the strains are such that when recrystallization on subsequent heat treatment occurs, most of the cube edges lie in the rolling direction. By this means, the "knee" of the saturation curve is raised considerably. Oriented steel has low loss and high permeability in the direction of rolling. It, therefore, requires fewer ampere turns to obtain a given flux density in the material. This has given the transformer designer a wonderful tool with which to reduce cost, size, or obtain better performance.

Designers of airborne electrical apparatus commonly employ 400 cycles, instead of 60 cycles, to help with their everlasting problem of reducing weight. This demands a core material possessing high permeability and low loss at this frequency. This led to the development of methods of orienting the grain of strip thinner than the 29-gauge (14 mils) commonly used in power-frequency transformers. As the gauge of silicon steel is reduced, although the permeability decreases and the hysteresis loss increases, the eddy loss decreases up to a point more than enough to offset them. The first step in this direction was the crea-

Fig. 1: (l) Comparison of 7- and 5-mil Hipersil with 12-mil material.

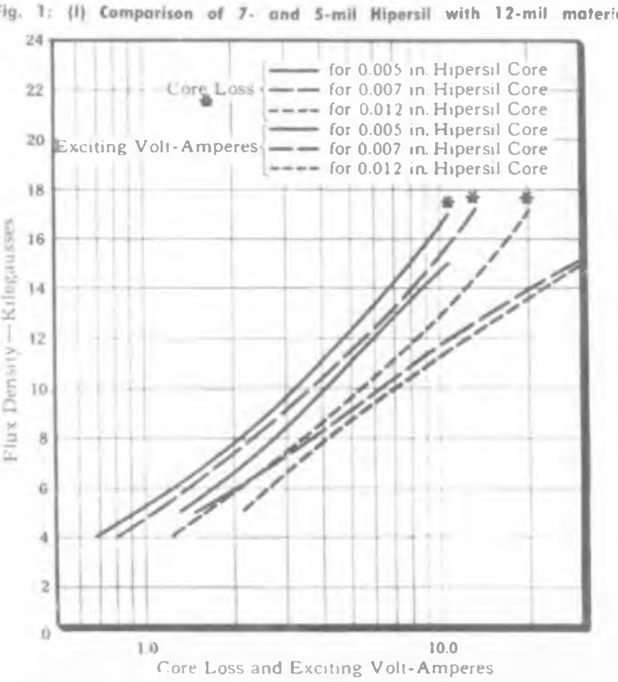
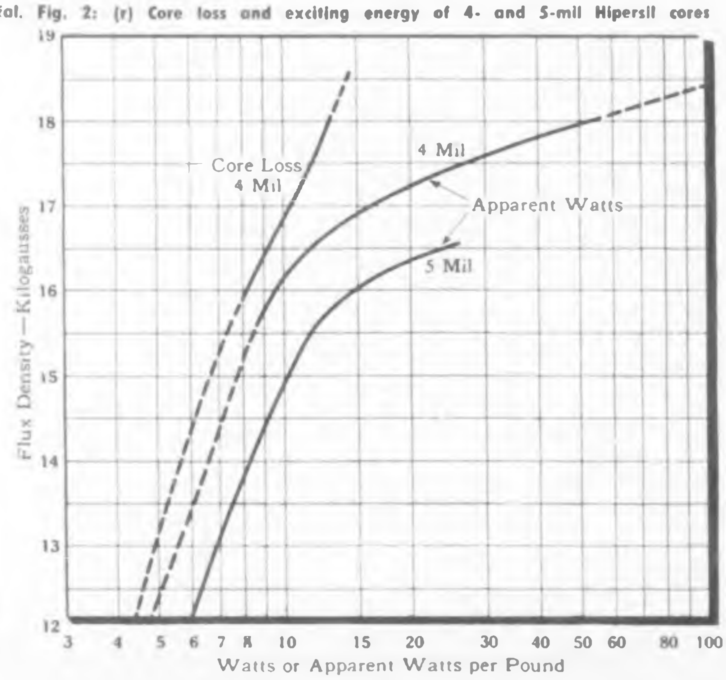


Fig. 2: (r) Core loss and exciting energy of 4- and 5-mil Hipersil cores



Transformers

magnetic amplifiers and and temperature stability

Fig. 3: Transformer at left, using 4-mil Hipersil, is 15% smaller than similar 5-mil unit

Fig. 4: Typical group of airborne, hermetically-sealed transformers using 4- and 5-mil Hipersil cores

tion of seven-mil thick oriented Hipersil cores during the early years of World War II. Continued work in this field brought a five-mil oriented steel, which, when made into the Hipersil core, gave the best balance of magnetic performance with economy of design. The five-mil Hipersil core has been the standard for obtaining minimum size and weight in 400-cycle transformers since 1945 and is being used in most of the airborne components being built by the military today. The curves of Fig. 1 illustrate the improvement in weight and size characteristics that can be obtained by using the five-mil Hipersil core in standard 400-cycle power components.

With the emphasis on miniaturization, a program was started three years ago to obtain a superior core material that would enable the transformer designer to make his components still smaller and lighter. The limitation with the standard oriented Hipersil cores in working them at high induction in small components has always been exciting current. If the transformer is worked at much above an operating induction of 15 kilogausses at 400 cycles, the exciting current becomes so large in comparison with the load current that the regulation is so poor as to make the transformer no longer operable. Recognizing this, the U. S. Navy Bureau of Aeronautics initiated a program of development for a superior magnetic material and core that would eliminate this exciting current limitation. Out of this has come a new type of Hipersil material possessing a very high permeability at high operating flux density. Cores made from this material have been developed through a cooperative research program with Armco Steel Corp., Westinghouse, and the Navy Bureau of Aeronautics.

The new material is four mils thick and has such a high degree of orientation that the minimum dc permeability is 1800 at a magnetizing force of 10 oersteds. Some samples have had a permeability as high as 1860. Theoretically the best permeability of pure *single* crystal under these conditions is 2015, but because of the slight impurities in the steel the best possible due to orientation is 1940. Core loss and exciting volt-ampere characteristics of four-mil Hipersil cores are shown in Fig. 2, and show their advantages at flux densities of over 17,000 gausses. The reduction of size and weight of 400-cycle transformers possible with the four-mil material is shown in Fig. 3.

Four-Mil Cores

As an example of what can be done with the new four-mil cores, during the past year a certain airborne electronic equipment was redesigned, using four-mil cores for transformers and other components. The resultant weight saving on the iron-cored components was 40%. This saving, of course, cannot be credited solely to the four-mil Hipersil core. Some is due to redesign and new performance specifications made possible by the use of this new four-mil material. The four-mil cores will have a distinct place in the development of miniaturized, high-temperature-rise transformers for airborne equipment. Some of these are shown in Fig. 4.

One of the most interesting and rapid developments of magnetic materials has been in that used for pulse transformers. These are used in radar equipment to transmit square voltage waves of short duration and high frequency. These last from a fraction of a microsecond up to several microseconds. The transformer must be capable of transmitting these steep front waves with great fidelity. The core material in a pulse transformer is the key to its performance, and, in or-

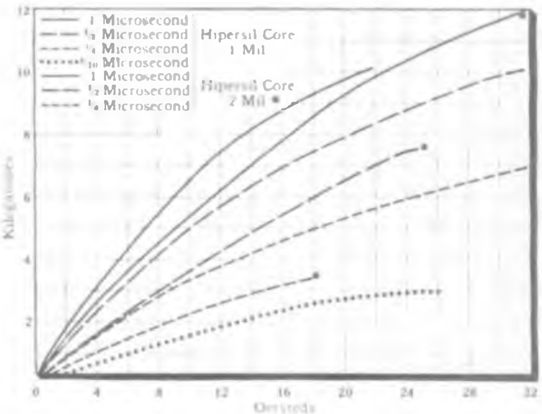


Fig. 5: (l) Comparison of effective permeability of 2- and 1-mil Hipersil cores. Fig. 6: (r) Extremely stable type-C core and a strip of the ribbed Hipersil steel from which it was wound

der that the transformer be made even reasonably small, the core material must have high permeability and low losses over a wide frequency range. In this type of transformer small size is essential for high fidelity.

For pulse transformers during World War II, Hipersil cores were developed and orientation achieved in material as thin as two mils without seriously affecting hysteresis loss. It was decided quite early in the development that thinness of gauge, high dc permeability, and low coercive force were the three criteria of performance for the core material. With advances in radar equipment, pulse lengths became shorter and shorter. This meant that, to achieve the ultimate in design performance in the pulse transformer, the material had to be thinner and still retain the high permeability characterized by oriented silicon steels. The purpose of the development that followed was to obtain good orientation in one-mil thick material. The one-mil steel is now being used regularly in some of the advanced radar and allied electronic equipments.

Core for Short Pulses

The figure of merit for a transformer core material of this type is the effective permeability with high rates of change of flux with respect to time. The definite superiority of the one-mil core for the very short pulse lengths is shown in Fig. 5.

As advances in the electronic art call for high-permeability cores for higher and higher frequencies, the material will have to be rolled thinner than one mil. Samples have already been prepared experimentally down to as low as one eighth mil thick, although at these thicknesses there is a considerable sacrifice with respect to coercive force and hysteresis loss. However, the development of the magnetic material can be counted on to keep pace with progress in electronic equipment.

To utilize these extremely thin materials effectively in transformer cores, it is necessary to make a wound-type core. The material is slit into a narrow ribbon, wound on a mandrel of required window dimensions, annealed as a unit, and then impregnated solidly with a plastic or resin compound to bind the laminations together. The wound core is then cut into two pieces to allow assembly with form-wound coils, and the core halves butted together with a low-reluctance joint. This is the most economical way to handle thin-gauge materials. Space factors, the ratio of the volume of core iron to the volume of core space, are high—90% for five-mil cores and as high as 89% for one-mil cores, which are much higher than an equivalent stacked core using the same gauge materials. Another advantage of the wound and cut type-C core is that the finished core in the transformer is in exactly the form in which it was annealed. This is an important factor in obtaining the ultimate in quality from these highly-oriented materials. The core is easy to assemble in the transformer coil and saves many man-hours in assembly time.

In 1951 another important development was made in the construction of wound type-C cores, especially in regard to the use of thin magnetic materials. Small lengthwise grooves placed in the strip of material as it is wound into a core add a great deal of stiffness. See Fig. 6. The resulting core is more stable mechanically and better in performance. The added strength in the core legs due to grooving contributes greatly to the core performance in the transformer in that it is much more stable during temperature cycles. This improvement has resulted in much better production performance for both core building and transformer building with these thin-gauge materials.

The development in thin-gauge, oriented materials has not been entirely confined to silicon steels. Recently, much work has been done in the development of oriented nickel alloys, particularly for magnetic-amplifier application. The orientation of these alloys differs from that of silicon steel in that a cube face is in the plane of the sheet, making one cube edge parallel to the direction of rolling and another normal to the direction of rolling. This results in a very square hysteresis loop as illustrated in Fig. 7. These square loops are desirable in magnetic-amplifier application. Depending on the power range, the design engineer applies either the oriented silicon or the oriented nickel alloy.

Perhaps one of the most interesting developments of the past year has been the development of small, ultra-thin gauge cores for high-frequency magnetic amplifiers or "flip-flop" magnetic components in computer applications. See Fig. 8. This development has both military and commercial significance. Here is a case where the circuit development had reached a point where there was no available magnetic material thin enough to reverse its magnetization with the rapidity required. Armco Research Labs. in a short space of time succeeded in rolling 3% silicon alloy, 50% nickel alloy, and 79-4 Permalloy down to thicknesses as thin as one-eighth mil. It is truly remarkable that even in these ultra-thin gauges the important magnetic properties of high permeability and low coercive force are retained.

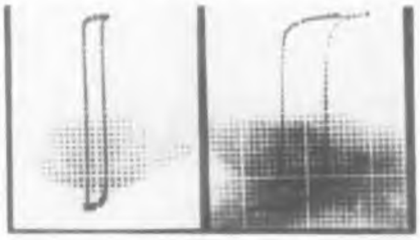


Fig. 7: Square hysteresis loops for (l) 2-mil Hypersil and (r) 2-mil Orthonik nickel-steel

Pilot production cores of this ul-

(*Continued on page 90*)

Q-Meter Correction Chart for

Q Voltmeter Loading

Nomograph corrects errors introduced by shunting effect of vtvm input resistance

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THIS nomograph is concerned exclusively with the shunting effect of the vacuum tube voltmeter input resistance that is connected directly across the Q capacitor. Note the basic Q-meter circuit of Fig. 1. This resistance, in parallel with the tuning capacitance, acts to lower the circuit Q as read by the Q voltmeter, thus reducing the measured, or apparent Q, from the true Q of the coil.

The voltmeter input resistance may be measured in the following way: A differential voltmeter of high input resistance can be connected to the Q capacitance terminals and the Q voltmeter alternately connected and disconnected. The increase in voltage when the Q voltmeter is disconnected, is related to the input resistance of the Q voltmeter as follows:

$$R = \frac{Q^2 + 50\Delta EQ}{50\Delta E\omega C} \text{ ohms}$$

where Q = measured Q with Q voltmeter connected

ΔE = increase in voltage when Q voltmeter is disconnected

C = Q capacitance

and $\omega = 2\pi f$

The finite input resistance of the differential voltmeter affects only the sensitivity of the measurement.

Another method of measuring the input resistance of the Q voltmeter, simpler perhaps than the previous method, consists of constructing an identical Q voltmeter circuit, substituting a spare voltmeter tube in the Q-meter itself, and measuring the actual Q voltmeter tube in the external circuit by connecting it in parallel with the Q capacitor.

Once the input resistance of the Q voltmeter is measured, other values required for the chart can be obtained directly from the Q-meter.

Example: If the input resistance of the Q voltmeter measures 0.38 megohms at 29 MC, the $F_{mc}R_{meg}$ product equals 11. Assume we have tuned a coil to resonance with 60 µµf of capacitance and the apparent Q (Q_a) measures 190. For this particular case we lay a straight-edge on the nomograph between 60 µµf and the $f_{mc}R_{meg}$ product of 11. Noting where this line intercepts the reference line, we pivot about this point and rotate the straight-edge to let it pass through a Q_a of 190. The ratio of Q_a/Q_o can be read as 0.95. Thus, the corrected Q equals 190/0.95 or 200.

Fig. 2. is an approximate curve of the $f_{mc}R_{meg}$ product as measured for the Q-meter used by the author. It is not necessarily representative of other Q-meters.

At low frequencies the input resistance consists mainly of a 100 megohm grid resistor in parallel with a resistance that represents the structual losses within the voltmeter tube. At high frequencies the input resistance is predominately due to transit time loss.

It is important to note that the loading produced by the Q voltmeter is only one of several sources of error. At high frequencies corrections are in order for the internal series impedance of the Q-meter. Then too, the presence of distributed capacitance across the inductor results in an error that requires correction at all frequencies when small values of tuning capacitance are used. A chart for the correction of Q-meter error introduced by distributed capacitance will appear in the next issue of TELE-TECH. When multiple corrections are necessary, they should be made in the order listed above, using the partially corrected values of Q and inductance in succeeding steps.

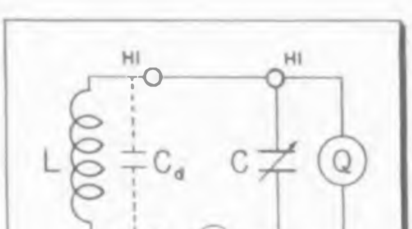
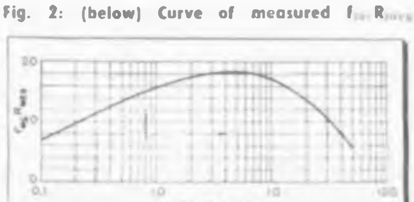
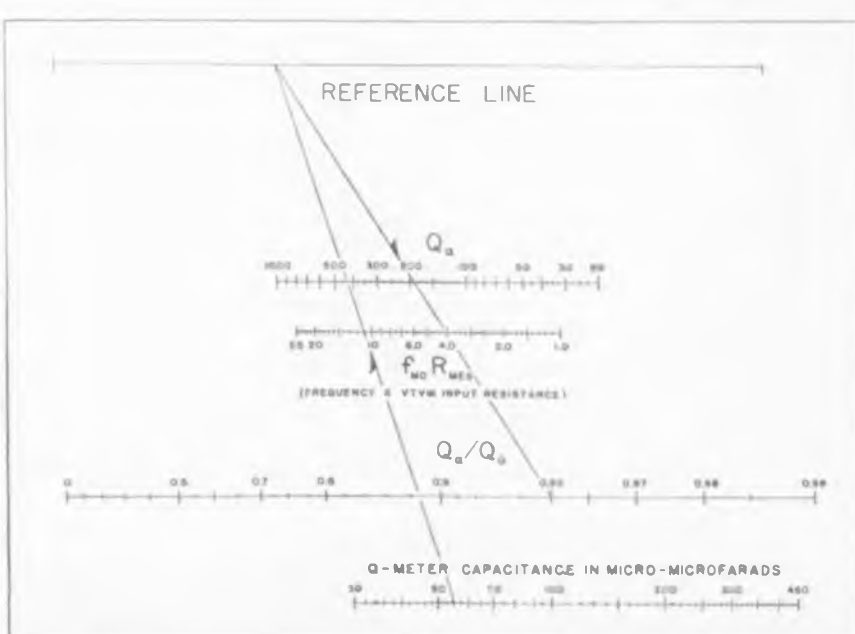


Fig. 1: (above) Basic circuit of Q-meter

(right) Correction chart for loading error

Fig. 2: (below) Curve of measured $f_{mc}R_{meg}$





Calibration of Commercial

Service offered to manufacturers certifies overall linearity and attenuator ratio measurements to 2% from 10 kc to 300 mc

By CLARENCE C. COOK
National Bureau of Standards
Washington, D.C.

BECAUSE of lack of uniformity of the various calibrating methods employed by different manufacturers, it has been necessary to provide an accurate calibration service for commercial field-strength meters to serve as a standard of comparison. For the past 20 years or so this service has been maintained by the National Bureau of Standards and has been available for general use. The original range of calibration was approximately 200 to 1600 KC. About 1946 this range was raised to the upper limit of 20 MC and later to 30 MC. More recently[1], after extensive research and development, calibration of sets covering the FM and TV bands was made possible with the inclusion of VHF calibrations from 30 to 300 MC. The lower frequency limit was extended to 10 KC. The purpose of this article is to give a general picture of the calibrating procedure employed at the Bureau at the present time.

The field-strength meters dealt with in this article can be divided into two general classes: VLF to HF sets having a frequency range between 10 KC and 30 MC, and VHF sets whose range falls within the frequency band 30 to 300 MC. Calibration of a field-strength meter usually consists of three steps: measurement of the antenna coefficient at specified frequencies, measurement of the relative attenuator ratios, and the determination of the overall linearity of the set. Upon request, other tests may be made, such as frequency calibration, stability, bandwidth measurements, and effects of power supply changes.

VLF to HF sets usually employ a shielded, unbalanced, tuned-loop antenna located immediately above the instrument's case. The attenuator may be entirely in the i-f circuit of the set or it may consist of a section in the r-f circuit as well. Attenuators generally provide step ratios and employ resistive or capacitive elements. VHF field-strength meters use a dipole antenna adjusted to approximately one-half wavelength and supported by a tripod. The antenna is connected to the set through an r-f transmission line 20 to 30 ft. long. The attenuator is of the same types as found in VLF to HF sets.

No Internal Adjustments

It is the policy of the Bureau to make no repairs or internal adjustments on field-strength meters received for calibration. Each set is given a preliminary test to determine its operating condition and to detect any obvious faults which would make a calibration impracticable.

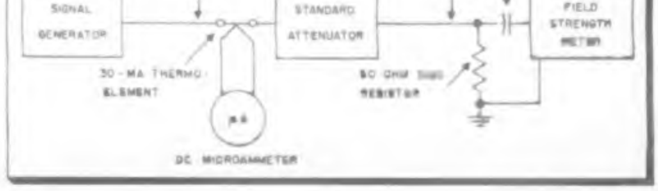
An accurate calibration requires a power source of constant voltage to operate the field-strength meter. If the power supply included with the set is not sufficiently constant, a regulated external supply is used. However, external connecting wires when used, must be positioned to cause no observable distortion or r-f pickup.

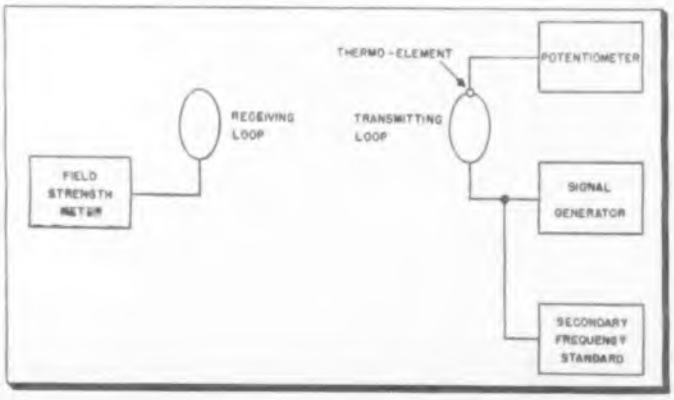
Before a calibration is begun, all equipment to be used is energized for at least one hour to reach stable operating conditions. The field-strength set is adjusted for normal gain during all tests. On most sets this is accomplished by means of an internal calibrating oscillator, whose output may be coupled into the antenna circuit.

Because of nonlinearity of dynamic characteristics of vacuum tubes and meter movements, it is necessary to determine the relationship between output indications of different values. For calibrating purposes a particular reading of the output indicator is used as a reference for all other readings.

In determining the overall linearity a stable r-f signal generator and a precision standard attenuator are required. A standard signal generator having an unbalanced output and an internal impedance of the order of 50 ohms is used. The attenuator is a 50-ohm, unbalanced, precision standard employing low-inductance resistive elements with a range of 100 db adjustable in 0.01-db increments. A 30-ma r-f vacuum thermo-element in the attenuator input serves as a means of monitoring the generator output and also protects the attenuator from overload. The output of the thermo-element is measured with a dc microammeter. The attenuator is terminated by a 50-ohm disc resistor. The r-f voltage developed across this resistor is loosely coupled to the input of the field-strength meter. Coaxial transmission lines are used between the different pieces of equipment. Fig. 1 shows the arrangement of the equipment during calibration.

Fig. 1: (l) Equipment set-up for determining linearity and attenuator ratios, VLF to HF. Fig. 2: (r) Antenna coefficient measurement using field-standard method, VLF to HF range





Field-Strength Meters

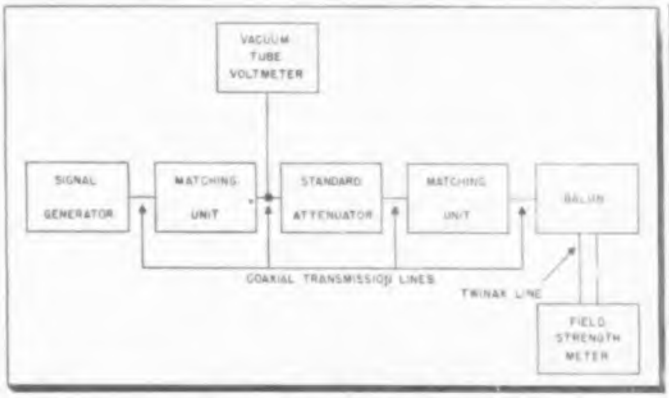


Fig. 3: (l) Arrangement used to determine overall linearity and attenuator ratios in VHF range uses balun and voltmeter monitor

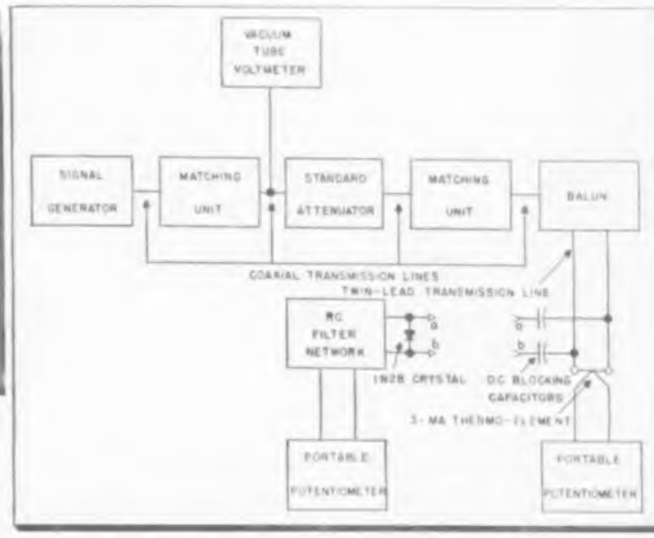


Fig. 4: (r) Calibrating crystal voltmeter used with standard antenna

After allowing the equipment sufficient time to become stable and having adjusted the power supply to its proper value, the field-strength meter is adjusted to normal gain. The signal generator and field-strength meter are tuned to an arbitrary frequency, usually about 550 KC. The generator output is adjusted for full-scale deflection on the output indicator of the field-strength meter. The output indicator reading, standard attenuator setting and thermo-element output are observed. Maintaining constant output from the signal generator, the standard attenuator is readjusted to give a slightly lower output reading on the field-strength meter, covering the range of the output meter scale in several small steps. Readings of the output indicator and standard attenuator are observed for each step. The corrections for nonlinearit, are computed from the data as follows:

Corrected reading for actual reading of $X = (V_c/V_x)$ CAL where

- CAL = Reading on the output indicator which is assumed correct
- V_c = Voltage ratio corresponding to the standard attenuator setting required to give a reading of CAL on the output indicator
- V_x = Voltage ratio corresponding to the standard attenuator setting required to give a reading of X on the output indicator.

Voltage ratios are obtained from a previous calibration of the standard attenuator.

All attenuator steps are measured relative to one position (usually marked CAL on the instrument) which is assumed to be correct. The equipment and its arrangement used in the measurement of the attenuator ratios are the same as used in the linearity test. With the attenuator on the field-strength meter on its highest position, the output of the signal generator is adjusted to give a reference reading on the output indicator of the field-strength meter. The output indicator reading, standard attenuator setting, and thermo-element output are observed. Maintaining constant output from the signal generator, the attenuator on the field-strength meter is set to each succeeding step and the standard attenuator readjusted to give the reference reading on the output indicator. Readings are observed for each step of the attenuator.

The relative attenuator rations are computed as follows:

Corrected ratio of attenuator step

$$X = \frac{V_c}{V_x} \text{ times CAL where}$$

CAL = Value of the attenuator step CAL which is assumed correct

- V_c = Voltage ratio corresponding to the standard attenuator setting required on the CAL position
- V_x = Voltage ratio corresponding to the standard attenuator setting required on step X.

Antenna Coefficients

There are two general methods[2] of determining antenna coefficients of field-strength meters: the standard-field method and the standard-antenna method. In the standard-field method the field strength at the receiver is calculated from the dimensions of the transmitting antenna, its current and current distribution, effects of the ground, and distance to the receiving antenna. In the standard-antenna method the field strength is determined from the voltage induced in a standard receiving antenna and the dimensions of this antenna. The standard-antenna method was originally used in the measurement of antenna coefficients of VLF to HF field-strength meters. However, this method was abandoned in favor of the more convenient and equally accurate standard-field method is used now.

Balanced Transmitting Loop

The present setup employs a one-turn, eight-inch diameter, fine-wire, balanced transmitting loop which is mounted in the penthouse on the roof of the Bureau's Radio Building. The antenna is energized by a standard signal generator (85 KC to 40 MC) having a 20-ohm unbalanced output. Special transformers convert this to a 20-ohm balanced output. A portable generator (10 to 100 KC) is used below 85 KC. The frequency of the generator is monitored by a secondary frequency standard having frequency intervals of 10, 25, 100 or 1000 KC. The resulting beat note is maintained within ±200 cycles by aural monitoring. The generator is connected to the loop input through a balanced twinax line. Radiation from this line is negligible over the frequency range used. The antenna current is measured by means of a 100-ma r-f vacuum thermo-element mounted in the loop center. A pre-

FIELD-STRENGTH METERS (Continued)

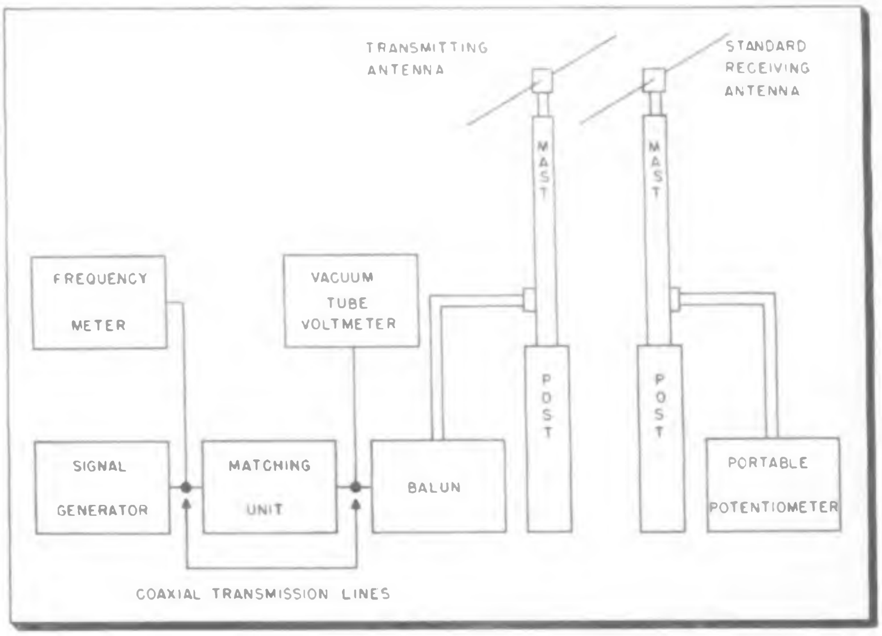


Fig. 5: Measuring antenna coefficient in the VHF range using the standard-antenna method

cision potentiometer measures the dc output of the thermo-element.

All antenna coefficients are measured using an antenna current of 100 ma. The quasi-static magnetic field is utilized. The field-strength is determined by the size of the transmitting and receiving loops, loop current and distance between loops. The equivalent free-space electric field strengths are computed from the following formula:

$$E = \frac{60\pi N r_1^2 I}{(d^2 + r_1^2 + r_2^2)^{3/2}} \sqrt{1 + \left(\frac{2\pi d}{\lambda}\right)^2}$$

where

- E = RMS field strength, μv/m
- N = Number of turns in transmitting loop
- I = Transmitting loop current, μa, rms
- r_1 = Radius of transmitting loop, meters; $r_1 < .02\lambda$
- r_2 = Radius of receiving loop, meters
- d = Distance between loop centers, meters; $d > 10r_1$
- λ = Wavelength, meters.

The validity of determining antenna coefficients in a quasi-static field in terms of a radiation electric field was confirmed experimentally.

With the equipment connected as in Fig. 2 the field-strength meter loop is properly spaced and the axis aligned with the transmitting loop axis. The generator is tuned to the desired frequency and the output adjusted to give the value of thermo-element output determined by a dc calibration of the thermo-element for 100-ma loop current. The field-strength meter is tuned to the generator frequency and adjusted to normal gain as before. With the attenuator set so as to give an on-scale reading, the output meter reading attenuator setting and frequency are observed. This is repeated at different frequencies in the range to be covered. The antenna coefficient for a typical make of field-strength meter is computed as follows:

$$K = F/M \cdot E/A$$

where

- K = Antenna coefficient
- F = Frequency, KC
- M = Output meter reading
- E = Field strength, μv/m
- A = Attenuator setting

Corrected values of output meter reading and attenuator ratios as determined in the two previous tests are used in the computations. The frequency factor, F, was added in the above equation arbitrarily to make the antenna coefficient, K, tend to be independent of frequency.

Calibration from 30 to 300 MC

Certification of VHF field-strength meters is a relatively recent feature of the Bureau's calibration service. It was made possible only after extensive development work on VHF field-strength standards.[1-3] This work was thoroughly checked by comparison of results obtained from the standard-field method and the standard-antenna method in actual propagation tests at 50, 100, 200 and 325 MC. The results obtained by the two methods agreed within ±5% at the three lower frequencies and within ±10% at 325 MC. The standard-antenna method was selected as being the more suitable in regards to accuracy and practicability.

The same general principles apply to linearity tests of VHF field-strength meters as are used in the calibration of VLF to HF instruments. However, the higher frequencies make the problem more difficult because connections must be carefully shielded to minimize radiation and impedance matching between the various test components must be rather precise to prevent high losses. The generator used for this purpose is a standard signal generator (40-400 MC) having an unbalanced 50-ohm output and maximum power of about 5 watts. The range 30 to 40 MC is covered by use of a generator similar to the one used on VLF to HF calibrations. The generator output is attenuated by standard mutual-inductance piston attenuator. The dial is calibrated in 0.01-db increments. A broad-band balanced transformer or balun converts from unbalanced to balanced output. This output is applied directly to the antenna input of the field-strength meter by means of the twinax line supplied with the instrument. An impedance matching unit is used on each side of the piston attenuator. Output of the generator is monitored by a high-frequency vacuum-tube voltmeter. Coaxial transmission lines are used to connect the various components of the setup.

For the linearity test the equipment is connected as shown in Fig. 3. The generator is set to an arbitrary frequency, usually 100 MC, and the field-strength meter is tuned to this frequency. Except for the use of the piston attenuator, balun, and the voltmeter monitor instead of the decade attenuator and thermo-element monitor, the test procedure and computations for VHF linearity tests are identical to VLF to HF tests.

Measurements of the relative attenuator ratios on VHF field-strength meters are made in the same manner as on VLF to HF sets except for modifications specified in the preceding test of overall linearity. The equipment is connected as in the linearity test (Fig. 3). This applies only to attenuators in the i-f circuit, however. R-F attenuators are calibrated by making antenna coefficient measurements on each attenuator step. This procedure is covered in a later section.

The determination of antenna coefficients of VHF field-strength meters necessitated the location of a field site which would be free of radio interference over the VHF range and would consist of level ground having no large objects nearby which might

(*Continued on page 96*)

Signal Corps Procurement Changed

Contracting Division Shuffled; Regional Offices to completely administer all contracts

THE Signal Corps Supply Agency in Philadelphia, Pa., from where nearly all Signal Corps procurement is done, has effected a major reorganization of the Procurement Group.

The important changes resulting from the reorganization include the activation of a Production Division and an Awards Division in lieu of the former Contracting Division; creation of an Economics Branch in which activities relative to pricing and financial matters are combined; and concentration of responsibilities pertaining to Government Furnished Property and Facilities in a newly organized Property Branch.

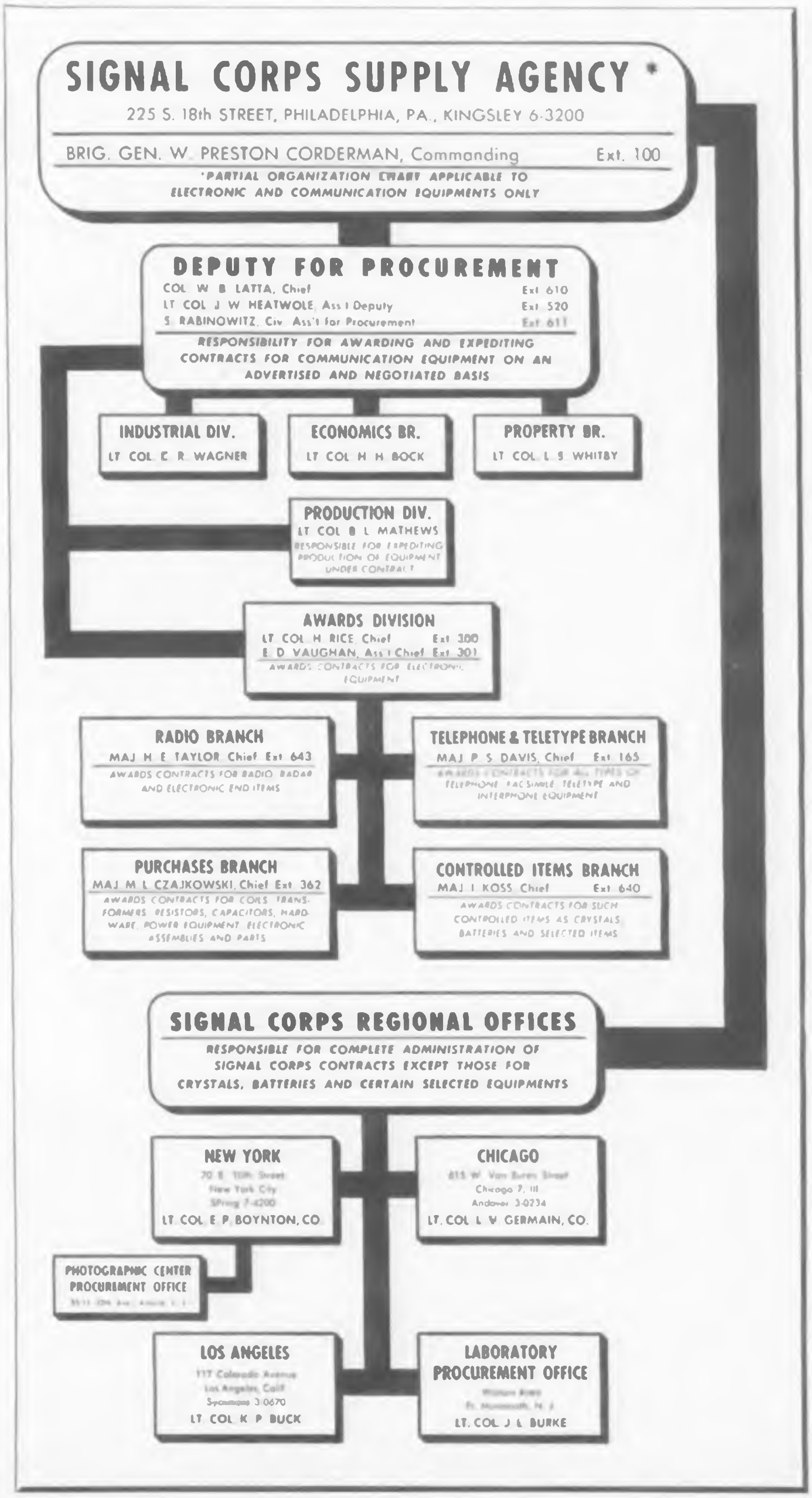
Establishment of the Production Division evidences the increasing emphasis placed upon securing prompt delivery of equipment to the Government.

The Awards Division is organized along both commodity and functional lines with a view towards obtaining the benefits of both types of systems in the placement of contracts.

Under a new policy, Regional Offices will completely administer all contracts within their respective geographical areas except those covering crystals, batteries and certain selected equipments. Contracting Officers located in the Regional Offices will henceforth assume complete responsibility.

Letters are being issued to all Signal Corps contractors holding open orders advising them of the nature of the change and informing them of the transfer of contract administration and includes appropriate instructions.

The new organization and its responsibilities as at press time, is shown in the accompanying chart.



Compiled by Lt. Col. Stanley Gerstin, Consulting Editor, TELE-TECH; Vice President & General Manager, Caldwell-Clements Manuals Corp.

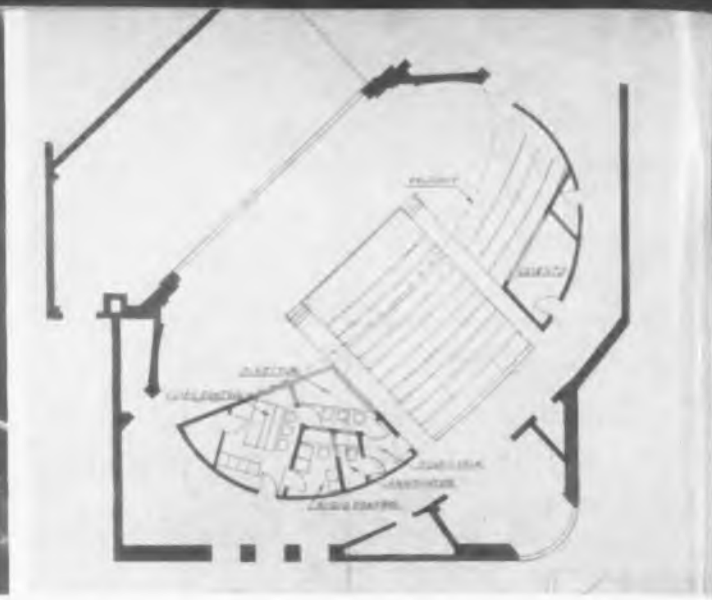


Fig. 1: (l) Early WABD control room has director, audio and video men in one room. Production problems result from high noise levels, possible confusion, and difficult audio monitoring. Fig. 2: (r) New TV studio plan shows split control booth, separating directing, audio and video functions

Television Control

Split arrangement segregates directing, video and audio functions to in undisturbed atmosphere. Application of plan to large, medium and

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THE arrangement of equipment in Studio Control Rooms and Master Control Rooms is generally determined by two broad factors: (1) the equipment selected, and (2) the program requirements. As these vary, so will the control room layout vary. At the same time, some degree of standardization is highly desirable. It is proposed to discuss several facets of this basic problem. First, the growth and development of what we refer to as the DuMont Standard Control Room will be described. Next, it will be shown how this applies in different ways to three different types of TV broadcasting stations.

Consider some of the qualities which a studio control room should have:

(a) Visibility of monitors
(b) Visibility of staging area
(c) Aural communication between members of production and technical staffs
(d) Visual communication between members of production and technical staffs
(e) Equipment location for ease of operation
(f) Equipment location for ease of maintenance
(g) Easy access to the studio area

Logically, a control room should, if possible, combine these qualities, consistent with equipment budgets and minimum personnel requirements.

The fundamental functions that take place in a control room are audio, video, and direction. In early control rooms, these three functions were generally placed together. A frequent arrangement consisted of a console in the front row, at which video control technicians and the audio control operator were seated. A raised desk in the rear was used by the program director and the technical director or switcher. Although there were variations of this arrangement, they were alike in that all functions were located in a single space.

Fig. 3: Split arrangement of Ambassador Theatre TV control room, layout shown in Fig. 2

Undivided Control Room

Fig. 1 shows the control room of Studio A at WABD. In this particular arrangement the program director and the audio man were in the rear row, and the video control operators and switcher were in the front row. Technically, this set-up is quite satisfactory. However, from the production standpoint there are disadvantages. Among these are:

(a) High ambient noise, consisting of a mixture of program audio, talk on intercom, talk on outside telephones, talk between personnel in the course of their duties.

(b) Confusion in the event of equipment trouble, with increased

Fig. 4: Photograph taken from audio section of Ambassador studio. Announce booth is on left, director's section and staging area ahead. Division of control functions allows undisturbed work

Room Layout

provide efficient operation small studios illustrated

chance for personnel errors.

(c) Difficult audio monitoring.

Several years ago when first converting the Ambassador Theatre in New York into a TV studio, what was called a split control booth was developed. Fig. 2 shows a floor plan of this theatre. Note that the audio, video and direction functions previously mentioned are separately divided. In addition, an announce booth has been added.

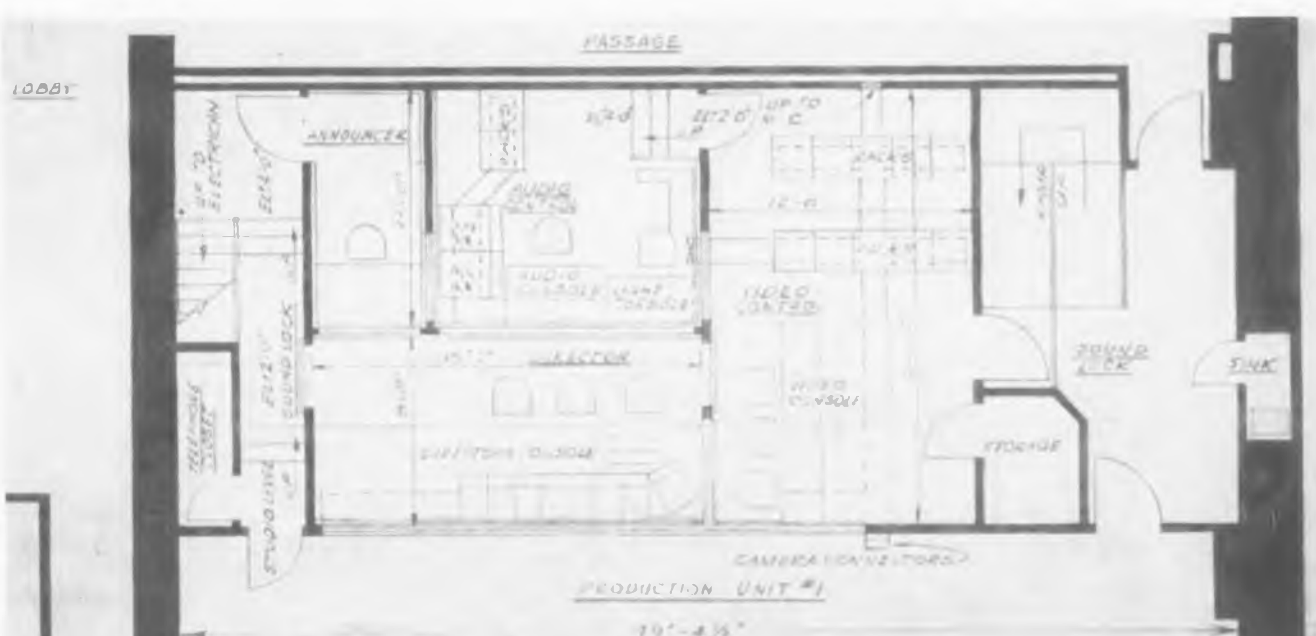
The peculiar shape of this particular control room is caused by the existing structure of the theatre, and it did complicate the design considerably. The section in the front contains the program director and the switcher only. In front of them are camera monitors, preview monitors, and line monitors. Directly in back of the switcher is a separate booth containing the audio operator. To the right of the audio operator is the announce booth, and to his left is the video control section. These spaces are connected by doors which are normally kept closed.

Glass windows permit the audio operator to see the announce booth on his right, the video control booth on his left, and the monitors in the director's room in front of him. He also has an excellent view of the acting area. The announcer, likewise, can see the audio operator on his left, the camera monitors and the acting area. The director, of course, has a full view of the acting area and the monitors.

The video control operators, who normally concentrate on the camera control units, do not necessarily need to view the studio, although it can be helpful at times. For example, on one occasion an accident on stage caused several lights on a set to go out. The operator quickly checked the studio by turning his head, before making any unnecessary camera adjustments and calling the camera operator on the intercom.

This arrangement has proved to be extremely satisfactory. The production staff, as well as the technicians, have found that this segregation has permitted smoother, more trouble-free operation. In the event of camera trouble, the director does not hear instructions passed from video control to camera. Likewise, the director does not hear conversations between studio control and master control, checking levels or line difficulties. The audio man can set his speaker volume as high as necessary for proper monitoring

Fig. 5: Standard control room as it would be laid out where no constructional limitations exist. Director and switcher are in front, audio in rear



without disturbing other members of the team. The director and switcher have audio monitoring facilities that can be adjusted to suit their need and can work in a relatively undisturbed atmosphere.

The split arrangement at the Ambassador studio is shown in Fig. 3. The director's booth is in foreground, announce booth left rear, audio control center rear, and video control right rear.

Fig. 4 shows a photograph taken from the audio section showing the announce booth on the left, the director's section and staging area ahead. Note the director's monitors.

Minimum Equipment

This type of layout requires minimum added equipment in the form of video and audio monitoring. DuMont camera control units have two standard video outputs, one of which is fed to the switcher, the other of which is fed to the added camera monitor in the production section of the booth. Audio speakers, with separate monitor amplifiers and gain controls, are placed in the video control section and the production section of the booth. This scheme was quite successful, and was developed further in the planning for the new 67th St. studios in New York.

Fig. 5 shows this standard control room as it can be laid out where there are no construction restrictions. The same general arrangement has been followed: the director and switcher in the front, the audio and announcer in the rear, and the video control section on the side. The production and video section are two feet above studio level, and the announce and audio section are four feet above studio level. Adherence to this arrangement in all new studios has been attempted, although certain modifications appear to be desirable at certain type stations.

Dual Studio

Fig. 6 shows how this same layout has been adapted to a dual studio set-up. Here space requirements forced the elimination of the announce booth on this floor level. It has been placed on a second level overlooking the studio. This type of control room layout is primarily designed for use in a station that is a network origination center and presumes a rather elaborate master control and projection room. Individual film cameras, the new DuMont film scanners, and other program sources will be fed directly to the studio control room. Film scanners or projectors will be started and stopped, slides will be changed, remotes will be cued and switched from the console in the production section of this studio.

A control room of this kind may be adapted to a station of smaller size, having two live studios, and using network and film. For this purpose plans for the new Hotel Raleigh studios at the DuMont station WTTG in Washington will be examined.

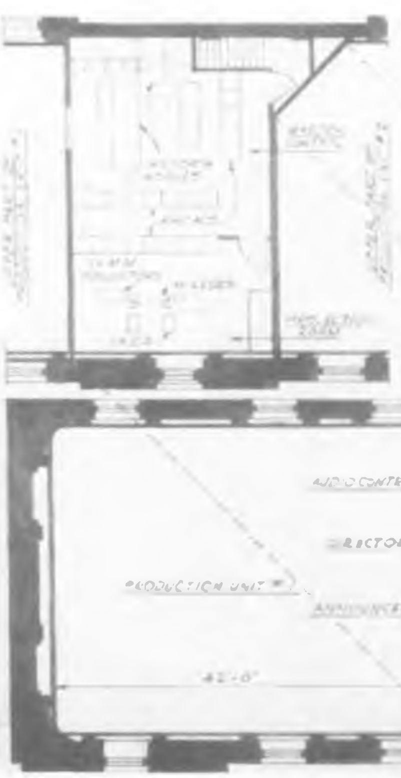
Network Feeds

In general, such a station combines a great deal of network feeds and film programs, with local live programs that do not require extensive rehearsal. Fig. 7 shows how units on the lower floor of the two-story structure are placed back to back as in the case of the dual arrangement in the New York studios. The basic change to the standard control room is that master control and studio video control are combined.

Such a plan still provides the proper segregation of the three functions, audio, video and production, and yet, at the same time, permits a variety of programming without the need for additional personnel.

Network to Live Program

Assume that a live program is immediately followed by a commercial film spot and then a network feed. At the conclusion of the live show the projector audio will appear on the studio console, and the video operator in master control will turn in his chair and handle the film camera controls. At the conclusion of the spot, network audio and video signals, levels having been previously checked and patched by the



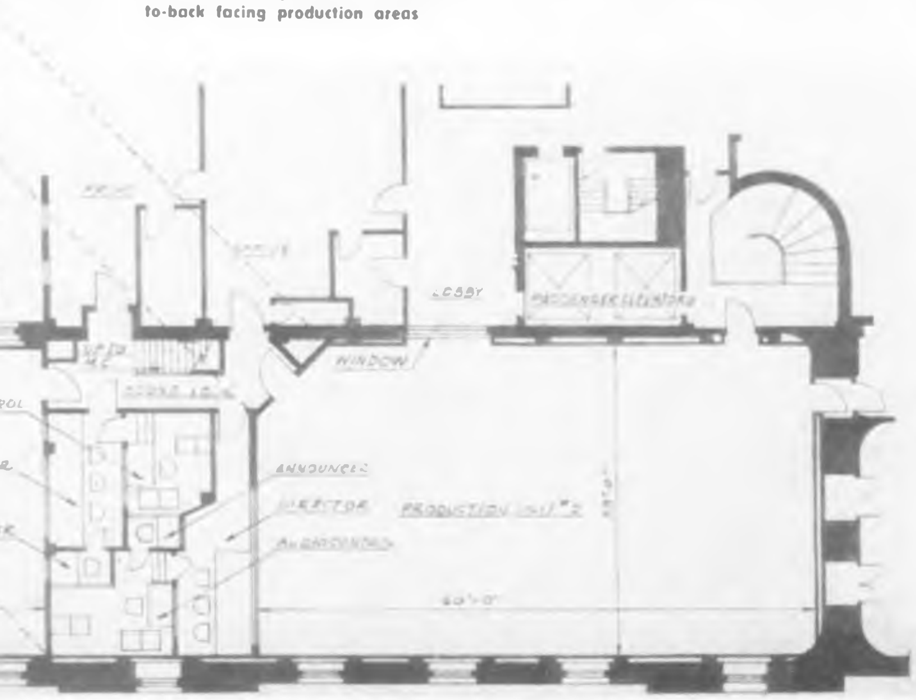


Fig. 7: Dual layout adapted to medium-sized station. Units in WTTG studios, Washington, D.C., are back-to-back facing production areas

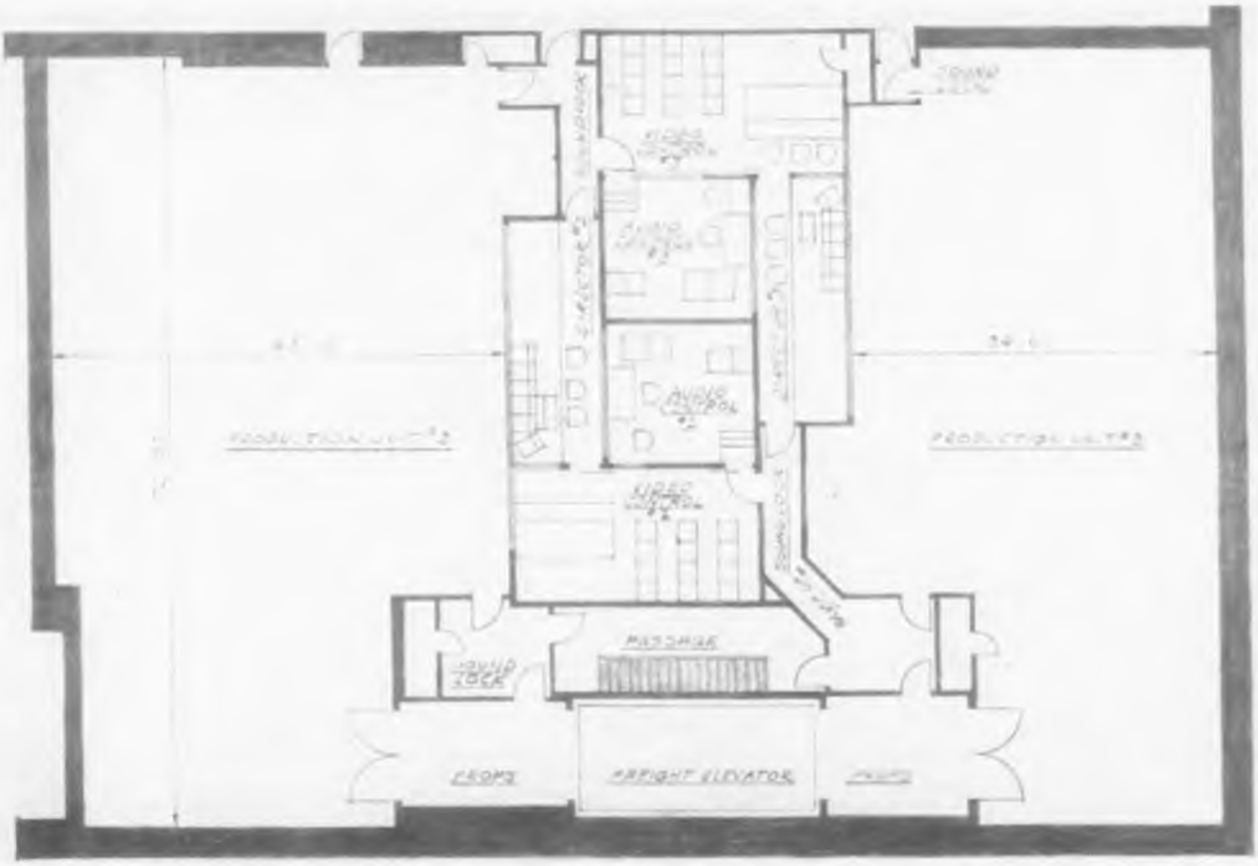


Fig. 6: Standard layout adapted to dual studio set-up. This type of control room is primarily for a station that is network origination center

technical supervisor, will feed directly through the master control section and be monitored at that point. This frees the switcher and audio man for another rehearsal or other duties.

Small Station

Now, finally, let us consider the type of station that depends on network feeds and film only for its program material. In this case it seems desirable to combine all operating functions at a master control point provided the arrangement allows for proper expansion at the time studios may be added.

Thus, although film and network can be easily handled at a common point, a separate studio control is highly desirable, particularly if live programs and rehearsals of any degree of complexity are contemplated.

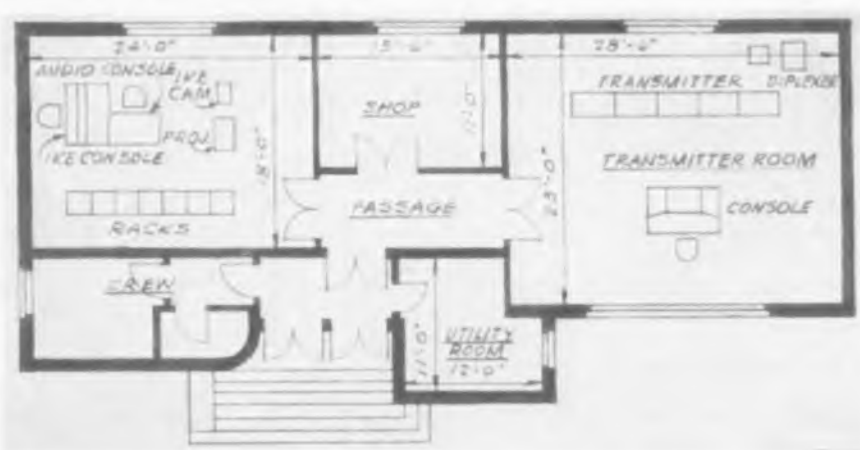
Original Transmitter Plant

Fig. 8 shows a floor plan of the original WDTV, Pittsburgh, transmitter plant, constructed in 1948. One man at the film console handled all video control and switching. Remote controls on the DuMont flying spot scanner, line amplifier and stabilizing amplifier are brought out at the film console. Thus all shading controls, gain and pedestal controls, slide change buttons and video switching controls are placed for ease of operation. Film monitors in the console are in front of the operator, and scanner and line monitors are rack mounted on his right. The audio console, directly in front of the video console, contained audio feeds from turntables, network, film and announce booth. The audio operator faced the rack mounted video monitors. The only additional technician needed to supply complete programming was the projectionist. A fourth technician remained on duty at the transmitter console, and a fifth man had overall supervision and was free for relief or to fit in where needed in an emergency.

Three Examples Covered

Three examples of control room layouts and some of the associated problems have been covered. Many arrangements can be designed to suit the needs of any particular station, and these needs will of course, vary with the type of equipment used and the type of programming desired. Based on broad and varied experience at DuMont, it is believed that these three basic layouts constitute an efficient use of space, equipment, and manpower.

Fig. 8: Floor plan of original WDTV transmitter plant, Pittsburgh, shows small station layout



Telemetering and Direct Frequency

Communications engineering techniques applied to remote measurement systems. Comparative evaluations made of operation, accuracy and time of AM and FM instruments

TYPE OF SYSTEM	PHYSICAL QUANTITY MEASURED	TRANSDUCER (TRANSMITTER)	CHANNEL	METER (RECIEVER)
AMPLITUDE SYSTEMS	TEMPERATURE	THERMOCOUPLE	2 WIRE LINE	POTENTIOMETER
	PRESSURE	MICROPHONE	SHIELDED CABLE	A F VOLTMETER
	POSITION	SERVO	3 WIRE LINE	SERVO & DIAL
FREQUENCY SYSTEMS	TEMPERATURE	VIBRATING STRING	TELEPHONE LINE	FREQUENCY METER
	DISPLACEMENT	CAPACITOR MODULATED OSCILLATOR	COAXIAL CABLE	DISCRIMINATOR & VOLTMETER
PULSE SYSTEM	WIND VELOCITY	ANEMOMETER, TOOTHED WHEEL & SWITCH	RADIO LINK	RECEIVER & LOUDSPEAKER

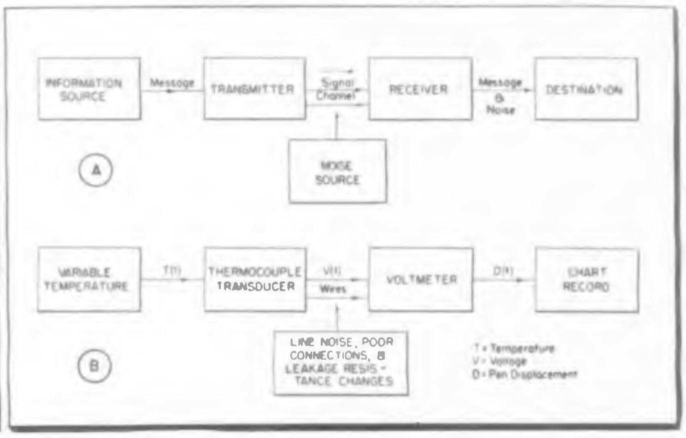


Table 1: (I) Examples of instrument systems for remote measurements. Fig. 1: (a) Elements of electrical and (b) instrument communication systems

By PAUL M. ERLANDSON
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San Antonio, Texas

MORE and more, problems of instrumentation concern themselves with communications over large distances. Manufacturing plants may be controlled wholly or partly from central points where the results of many measurements are available. In guided missile test flights or in operation of nuclear reactors, remote measurements are absolute necessities.

The great majority of communications systems are electrical and have the elements shown in Fig. 1A. The message from the information source is converted into a signal by the transmitter. The signal is sent along a channel to the receiver, which converts the signal to a message acceptable at the destination.

These elements may be compared with those of a typical instrument communication system, as shown in Fig. 1B. The information source is some system where the temperature, T(t), varies with time. The message introduced into the transmitter or transducer is therefore a time-varying physical quantity. The transducer, a thermocouple, changes temperature variations into voltage variations, V(t), which constitute the electrical signal.

The signal is transmitted over a channel, which in the illustration may consist of ordinary wires. Electrical noise is unavoidably introduced into the channel by poor connections, nearby wires carrying other voltages, variable line leakage, changes in line resistance due to temperature, etc.

Both signal and noise reach the receiver, in this case a voltmeter which is part of a chart recorder. The signal is converted into a message which is displacement, D(t), of the chart recorder pen as a function of time. Each displacement of course corresponds to a certain temperature, depending on the errors introduced by noise, etc. The final destination of the information is the chart.

The process illustrated is actually communication between two machines—yet it is governed by the same laws as, say, telephone communication between two persons. Many of the practices and ideas of communication engineering are found to be of increasing value in instrumentation as the latter becomes more complex.

In radio and TV, signals in which the carrier frequency is varied or modulated have been found to be more useful for many purposes than signals in which the carrier amplitude is modulated. Advantages have also been found for signals where the carrier is turned on and off at intervals or pulse modulated. The principal reason for such benefits in FM and PM is that most channel noise disturbances between the transmitter and the receiver are variations in amplitude, and this noise can be effectively suppressed by receiver of FM and pulse signals. Fig. 2 presents typical examples of MA, FM, and PM signals for the transmission of a message which might consist of four different values of the pressure of a gas. There are other modulation systems, but those shown are the principal types.

Five Basic Systems

In the language of instrument engineers, basic systems of telemetering are sometimes classified into five systems: Current, Voltage, Frequency, Impulse, and Position. In a review of these types of instruments, it has seemed impossible to justify this many categories. It is suggested that the most general categories are three in number: Amplitude Systems, Frequency Systems, and Pulse Systems. Subdivisions of Amplitude Systems could include current, voltage, or position as pertinent. This suggestion is open to discussion of such matters as phase systems, which find the least in common between instrument and communications practices.

Before listing factors of importance in this evaluation, it is of interest to introduce several ideas from communication engineering practice.

The channel in most instrument

Measurement

PART ONE

OF TWO PARTS

systems, very often consists of ordinary wires. It has not been too expensive to use separate wires for each measurement. Thus, this element has been given little consideration in the design of transducers or receivers or meters. As the distances over which instruments must communicate grow, channel considerations become more important. Even over short distances, transmission of a large number of measurement messages may benefit from channel design beyond ordinary wires.

Channel Time Inexpensive

In wire or radio communications, channel time has always been relatively expensive. Thus, it is not surprising that much time and effort has been devoted to development of systems which can transmit the maximum amount of information during the shortest possible time over the least expensive channel. Recent advances in communication theory have shown that more messages can be sent over a given channel in a given time if each message does not need to be absolutely correct. This theory, which is statistical in nature, may be expected to influence instrumentation in time.

To evaluate overall systems, then, we must take account of the following factors:

1. *Overall Measurement Accuracy:* This factor, expressed in percent of the measured value (not in percent of full-scale instrument reading) may be evaluated in terms of the value of the measurement. It may not be as important as time or reliability in some cases.

2. *Measurement Time:* This factor is primarily important in relation to use of the measurement for control purposes and in relation to the speed of the process being measured. If a given measurement can be made fast enough, the transducer might be arranged to send a signal each time a prearranged change occurs in the quantity being measured, rather than at regular intervals. This might save channel time as well as recording chart space.

3. *Measurement Reliability:* This is measured as the percent of total measurements which are actually within the desired limits of accuracy. In systems where data are averaged, 100% reliability may not be necessary. "Fail Safe" is a consideration.

4. *Message Presentation:* This is evaluated in terms of operator skill and effort necessary to obtain and interpret the output data or message. An instrument which indicates the square of a current value may be less useful than another which reads current directly. A device which requires adjustment of controls and observation of a null indicator may be less satisfactory than an automatic device, particularly for control or recording purposes. Quantitatively, these properties can be evaluated in terms of the labor costs they incur and the contribution of human errors toward reducing accuracy and measurement reliability and increasing measurement time.

5. *Cost:* This factor is determined quantitatively by the actual value of the measurements and the time over which they can be made under original specifications of the above quantities. Included here is the cost of maintaining and checking accuracy, which involves performance under adverse operating conditions: the frequency that recalibration is required, the difficulty of recalibration, and the availability of calibration standards. Since cost is usually inversely proportional to size and weight, the latter are classified here.

To correlate and simplify the results of the foregoing, it will be easier to speak of an instrument communication system as composed of a transducer, a channel, and a meter—remembering that the transducer serves as a transmitter and the meter as a receiver. Table 1 lists examples of amplitude, frequency, and pulse systems used for remote measurements. An attempt has been made to secure a variety of combinations of elements, and not to represent any particular advantages or disadvantages of a given system.

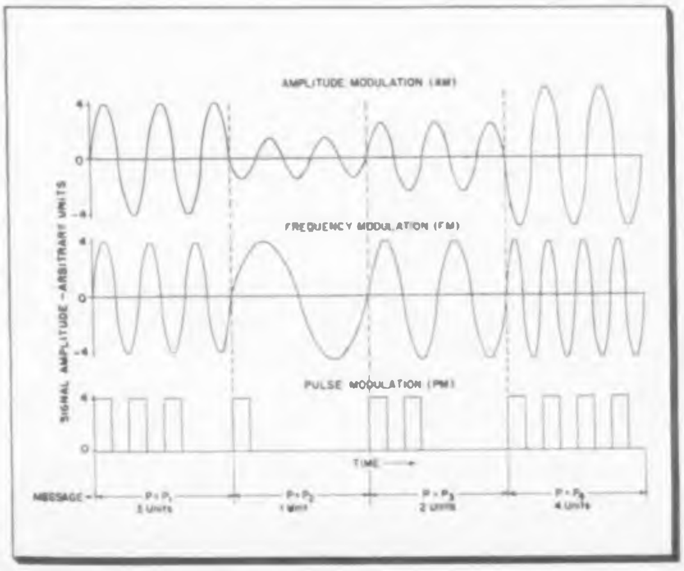
Type of Modulation Used

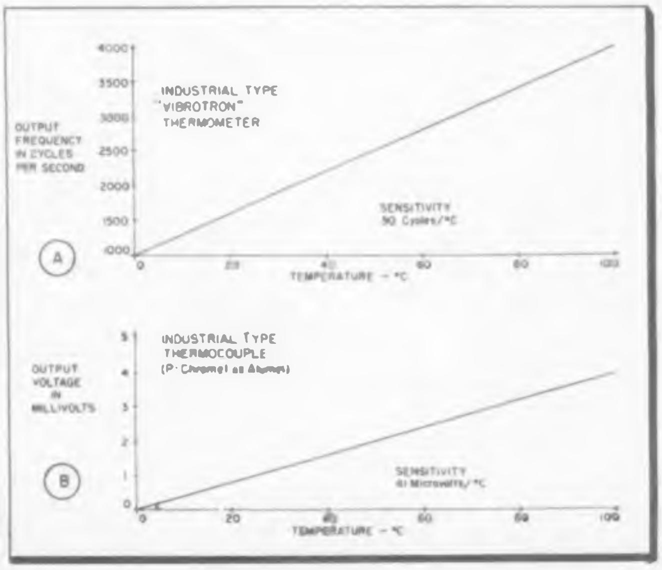
The type of modulation to be used in any system depends primarily on available transducers and meters. Most of those available use AM, probably because so many convenient meters and recording devices are available. It is quite likely that the lack of transducers using FM and PM systems is due to a previous scarcity of meters for converting FM and PM signals directly into meter readings.

Southwest Research Institute has devoted considerable attention to FM transducers. One of these is the

(*Continued on page 86*)

Fig. 2: (l) AM, FM and PM signals for four values of pressure. Fig. 3: (r) Comparison of (a) frequency and (b) amplitude transducer characteristics





CUES for BROADCASTERS

Practical ways of improving station operation and efficiency

Conelrad Alarm

JAMES F. LAWRENCE, Jr., Chief Engineer, KMGM, Culver City, Calif.

THE circuit operates with any receiver using AVC. Plate and filament voltages can be taken from the receiver or from a separate source. Operation is as follows: negative AVC voltage applied to the grid of the first section of the 6SN7 reduces the current through R_1 to a very low value. In this condition, the voltage across the potentiometer is nearly equal to the B supply voltage, a portion of which is applied to the second grid. This positive voltage on the grid tends to counteract the bias voltage developed across the cathode bias resistor R_2 and allows sufficient plate current to flow to just hold in the relay. If the carrier of the station to which the receiver is tuned is cut, the AVC voltage will be removed from the grid of the first section of the 6SN7 which will draw plate current and in turn cause the voltage across the potentiometer to decrease because of the increased IR drop across R_1. The voltage on the grid of the second section will no longer be high enough to balance out the cathode bias voltage and the plate current will be reduced, allowing the relay to open, completing the bell circuit and at the same time opening the cathode circuit so that restoration of the AVC will not stop the alarm bell until the reset button has been pressed.

$$$ FOR YOUR IDEAS

Readers are invited to contribute their own suggestions which should be short and include photographs or rough sketches. Typewritten, double-spaced text is preferred. Our usual rates will be paid for material used.

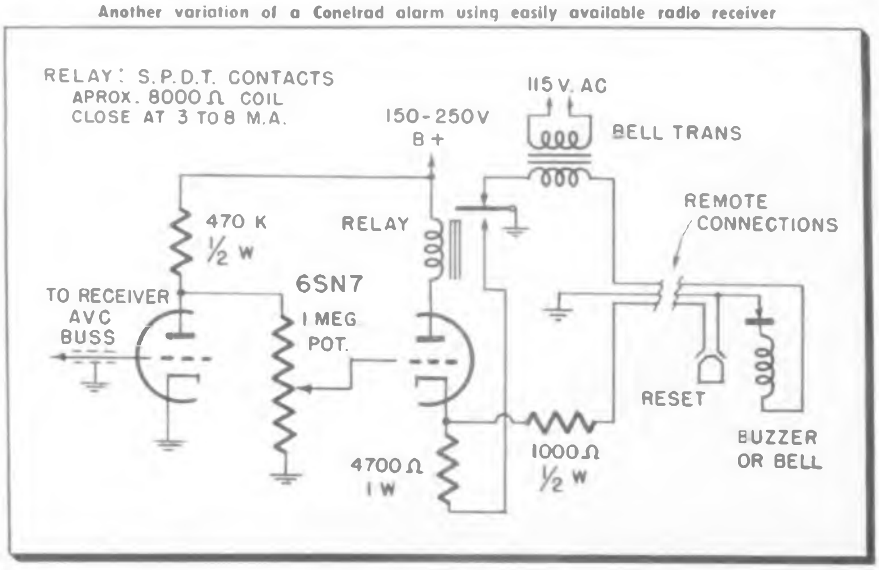
Voice Video

BOB HOLT, Chief Engineer, KATE, Albert Lea, Minn.

HERE is a gimmick that never fails to attract attention at special events in which broadcast stations frequently find themselves involved. The observer sees and hears his own voice repeated by depressing a button and speaking into a mike in an unattended device. A tape puller is required with three heads and an oscilloscope—if desired. Our Presto works very nicely by switching around the heads and setting the puller upside down on the edge of a table out of sight of the viewers. The reels are removed, and one is used as a weighted pulley for the bottom of a continuous loop of tape. The recordable time and delay depends on the length of the loop.

The display seen by the viewer is a "magic" box with only a speaker grille and the face of the scope showing. He speaks into a conveniently located mike while holding the "press to talk" switch. Upon releasing the button his voice comes back over the speaker and can be seen on the scope. The machine is set to record and runs continuously without attention. A small sign with instructions is helpful.

Another variation of a Conelrad alarm using easily available radio receiver



Rejuvenating Old Discs by Applying Lubricant

H. BROOKS, WKLX, Lexington, Ky

SOME old records were acquired to be used on one of the WKLX record shows. Some of the discs dated back as far as 1920, and had been treated rather badly, so the noise level was very high. We used the following process to reduce the surface noise to a level at which the discs could be used.

First, we washed the discs with warm water and mild soap, and rinsed thoroughly. After drying with a lint-free towel the surface noise was found to be considerably lower. But, still too high for broadcast use. Then we cleaned the discs with carbon tetrachloride and applied a liberal coat of vaseline. After removing the excess vaseline and playing through once to remove the lubricant from the grooves the surface noise was found to be sufficiently low. Application of a lubricant to the disc is used only in extreme cases but a good washing is helpful any time and does not damage the disc. Discs treated with a lubricant must be protected from dust.

Cuing Instantaneous Recordings

RAY WILLARD, WISL, Mount Carmel, Pa.

TO provide a foolproof means of cuing an instantaneous recording without "back-tracking" or counting grooves from a certain spot on the disc, we use a method that has proved satisfactory here at WISL. Because instantaneous recordings are usually made on a soft surface and must be discarded because of break-down of the grooves due to back tracking, this method greatly lengthens the life of a record by eliminating the necessity for cuing.

Before beginning the spot announcement, modulate the disc with a 1,000 cycle tone for a few moments and follow this with two turns of silence on the disc and then immediately begin whatever is to be recorded. Do this at the start of each cut and once a habit is established it provides a simple and easy method for the control room operator to cue a recording prior to placing it on the air. It is only necessary to play the recording on audition to the spot between the end of the tone and the beginning of the intelligence, stop the disc and let the pick-up rest at this point until air time.

Disc Reverberation

J. B. STRAUGHN, 107 Woodbridge Ave., Silver Spring, Md.

A simple way of introducing a variable amount of reverberation into music and speech coming from a disc is to mount a second pickup wired in parallel with the main pickup and place its stylus behind the main stylus. Depending on the displacement between the two styli the re-echo will be long or short.

If desired, a number of pickup mounting holes can be drilled in the top of the turntable mounting and used to provide a variable degree of delay according to the type of program in use. This type of delay is suitable for all types of recorded programs.

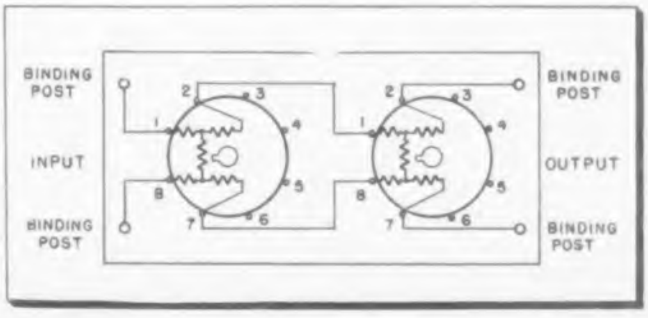
Pad Storage

CECIL TANKERSLEY, Chief Engineer, WMOG, Brunswick, Georgia

HERE is an excellent way to keep pads safely and know the exact impedance and loss of each. Remove the tops from a number of discarded metal tubes, clean out the inside of the base, and remove all leads to the prongs. Tubes with at least pins 1, 2, 7 and 8 intact should be used, and all connections should be made to these pins to standardize the setup.

Construct pads from resistors of the proper value for the desired impedance and solder the input to one set of pins, say 1 and 8, and the output to the other set of pins 2 and 7, then crimp the top of the tube back in place. Paste a gummed label showing the db loss and impedance on the outside of the tube shell, and there is a handy pad that can be handled and stored without fear of resistors being torn loose.

A number of these pads can be made up for future use. One shorting pad should be included with connections from 1 to 8, and 2 to 7. For use, mount two octal sockets on a strip, with binding posts at each end. Connect the input of the first socket to pins 1 and 8, and the output pins 2 and 7 of the first socket to 1 and 8 of the second socket and pins 2 and 7 of the second socket to the output binding posts. You now can easily set up various values of loss and impedance. If only one pad is needed, the shorting pad may be placed in the extra socket.



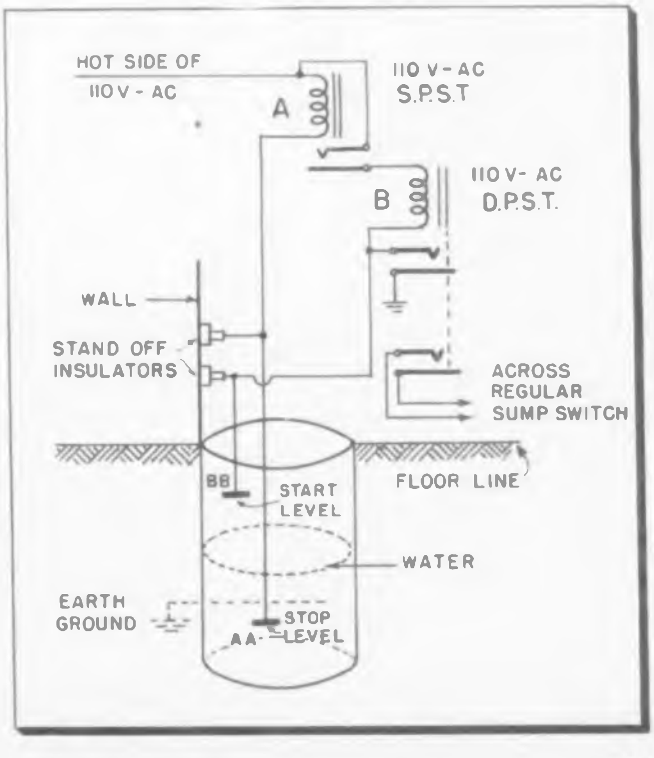
Metal tube cases make sturdy plug-in pads

Sump Pump Switch

LLEWELLYN JONES, Chief Engineer, WSBA, York, Pa.

THIS idea is a little out of the broadcast line, but we have been troubled by water seeping into our basement. On two occasions, the switch on the sump pump failed to operate due to rust and corrosion in the switch. As a result our basement was flooded. The damage: three motors shorted and a transformer waterlogged. To prevent additional mishaps of this kind, an emergency control was connected across the regular start-and-stop switch. Relay A is energized when the water level rises to contact AA. Contact AA is an aluminum rod mounted on an insulator extending about four inches from the bottom of the well. When the water reaches the height of contact BB, also an aluminum rod, relay B closes, holds through its own contacts and relay A contacts. The pump runs until the water level falls below contacts AA, thus de-energizing a relay A, releasing relay B, and stopping the pump. (*Ed. Note: owing to danger of high voltage line being exposed the aluminum rods should be run inside larger plastic tubes for insulation.*)

Failure-proof automatic sump-pump switch makes use of water conduction →



Cleaning Tape Recorder Mechanism

HAROLD H. NEWBY, Chief Engineer, KAKE, Wichita, Kan.

ENGINEERING maintenance men at KAKE have found that cotton tipped swabs such as "Q TIPS" are very convenient for cleaning tape recorder heads, drive pucks and idlers. They are readily available at almost any drug store. The swab may be dipped in whatever cleaning fluid one prefers and the excess flipped off. We find this much more satisfactory than trying to use a piece of cloth wrapped around a stick or screwdriver blade.

Remote Control for Studio Amplifiers

R. S. HOUSTON, Chief Engineer, KNBZ, La Junta, Colo.

IN cases where the only engineering staff is at the transmitter, leaving the studios completely in the hands of relatively non-technical personnel, there arise times when it is impossible to obtain the desired circuit setup for special

(*Continued on page 84*)

Second Detector S/N Improvement

Consideration of division of noise into ac and dc components in pulse radar linear receivers eliminates errors in calculating noise figures

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THE specification of receiver sensitivity is intended to insure desired performance, but this performance may not be attainable within the limitations set by "the state of the art." All too often this fact is discovered the hard way—by constructing the receiver and finding that it does not and cannot be made to meet performance requirements. A much more economical way of discovery would be to examine the design itself, in advance of construction, to see whether or not it is practicable.

A criterion of practicability is the noise figure of the receiver because it is known that, granted the "state of the art," a certain noise figure is the best attainable. Since the sensitivity and the noise figure are intimately related, it should be possible to find the latter knowing the former. In the past the only valid, though uneconomical, method of finding the receiver noise figure was to construct the receiver and make measurements. There is a frequently used method of calculating noise figure from the specification which defines sensitivity in terms of a signal-to-noise indication on an oscilloscope, but this method yields erroneous results because it overlooks the division of noise into dc and ac components in the output of the second detector. The key to the valid assignment of receiver noise figure rests upon the proper understanding of the action of the second detector with regard to this noise division.

It is the purpose of this paper to show that such understanding leads to a definition of noise figure that meets the test of experimental results. The discussion is confined to pulse radar types of linear receivers and to signals as large or larger than average peak noise. The noise as well as the signal is assumed large enough to cause the second detector to operate in its linear region.

Fig. 1: Installation for measuring receiver noise figure. Meter reads receiver noise with zero output from noise generator. Generator output is increased until meter reading is doubled, so output equals noise of receiver

Second Detector Operation

A linear detector with zero fixed bias is specified by the relations: $I(t) = 0$, $V(t) < 0$, and $I(t) = \alpha V(t)$ $V(t) > 0$, where $V(t)$ is the input voltage, $I(t)$ is the output current, and α is the constant of detection. If the signal at the input to the detector consists solely of noise and if the detector has unit load impedance, the following relations apply:

$$V_{dc} = \frac{\alpha \, \overline{[V_{nif}(t)]^2}^{\frac{1}{2}}}{\sqrt{2\pi}} \qquad (1)$$

$$\left(\overline{V_{ac}^2}\right)^{\frac{1}{2}} = \frac{\alpha}{\pi}\left(2 - \frac{\pi}{2}\right)^{\frac{1}{2}} \overline{[V_{nif}(t)]^2}^{\frac{1}{2}}$$

$$= \frac{\alpha}{\sqrt{8\pi}} \overline{[V_{nif}(t)]^2}^{\frac{1}{2}} \qquad (2)$$

where V_{dc} is the dc noise voltage at the output of the second detector, $(\overline{V_{ac}^2})^{1/2}$ is the rms low frequency noise voltage at the output of the second detector, and $\overline{[V_{nif}(t)]^2}^{1/2}$ is the rms noise voltage at the output of the i-f amplifier or, what is the same thing, at the input to the second detector. The quantity α can, to good approximation, be taken as unity, so it will be dropped from further discussion.

Comparison of Eqs. (1) and (2) shows that the dc component of noise is twice the rms low frequency component. This fact is determined solely from analysis of the Fourier content of the signal and does not arise from consideration of time constants in the output of the detector. In practice the RC load in the output of the detector has a time constant large compared to the period of variation of the i-f components of the input noise signal, but small compared to the period of variation of its envelope. The i-f components of the noise signal in the output will, consequently, be shunted to ground; the dc components in Eq. (1) will fix the bias level on the diode; and the capacitive coupled output will consist solely of the ac component of the noise given by Eq. (2).

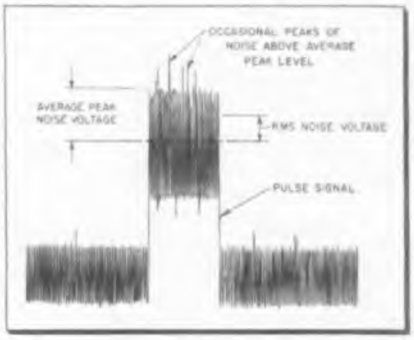

Fig. 2: Oscilloscope presentation of noise and signal. Average peak and rms noise are shown

For a pulse signal, if the duty cycle is small, the dc level in the output of the second detector can be neglected, and essentially the entire output signal, excluding i-f energy, is low frequency ac. The signal-to-noise ratio, as viewed on an oscilloscope connected to the output of the second detector, is conveniently expressed in terms of the ratio of pulse signal amplitude plus average peak noise (sometimes called tangential noise) to average peak noise. Symbolically, $N = (\hat{V}_s + \hat{V}'_{ac}) / \hat{V}_{ac}$, where $\hat{V}_s$ represents the peak amplitude of the signal (the height of the pulse in the present study, $\hat{V}'_{ac}$ the average height of the peaks of the noise on top of the pulse, and $\hat{V}_{ac}$ the average height of the peaks of the noise on the base line.

With the aid of this definition and Eqs. (1) and (2), an expression can be derived for the ratio of the signal-to-rms noise ratio at the input to the second detector, to the signal-to-rms noise ratio at the output. This ratio of two ratios is greater than one and represents an effective improvement in signal-to-noise ratio when read on an oscilloscope, a device which is sensitive to the ac components of the output noise only. That is, the improvement in signal-to-noise ratio is a consequence of the division of the rectified noise into dc and ac components. The expression for this ratio, termed the

(Continued on page 102)

"Reservisor"—

A memory drum-computer which checks seat availability on 10,000 airplane flights in a few seconds

Fig. 1: Agent set with coded information plate queries storage drum to find seat availability

By CRAIG ANDREWS
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New York 7, N.Y.

IN the early part of July this year, a totally automatic "Magnetronic Reservisor" was put into operation at the American Airlines' reservation office at LaGuardia Field in New York. It represents eight years of joint development by the airline and The Teleregister Corp., the manufacturer, during which the combined outlay went to about a half million dollars.

Before this time, sales agents who carried on business over telephones checked a large board with placards indicating open flight space. Not only was this board, at its best, many minutes behind the sales, but it was very hard to read from the agents' desks. This board showed availability for only three to five days in advance, and many sales after that period had to go through more paper work and interoffice phone calls.

The Reservisor now presents to an agent, within a few seconds, the immediate ability to check availability, and to sell or cancel, one to four seats of any eight flights at a time in certain combinations from a total of 1000 flights per day for a ten day advance period.

The unit used by the agent, the agent set, Fig. 1, resembles a small desk adding machine. With each agent set there are 46 plates that slide into the set with the flight information written on them. On each plate there are 64 flights, and an operator may see 16 of these with no movement of the plate. The bottom of the plate is coded with slot combinations to enable each plate to pick out one small portion of the stored information from the storage drum. The agent never knows the exact number of available seats in a flight but only that there are enough or not enough seats to make the transaction.

The input information from these agent sets is a date, a seat number, the plate coding, and the type of call. This information is locked up in relays as the electronic elements process the call. It should be noted that only one call may be processed at a time, so only one agent set may be connected at a time. To do this each set asks a seeker if it may ask a question. If no other set is connected at this time, the set is connected. If another call is being processed, it must wait its turn to get an answer. With this system, it takes an average of one second to process a call.

In the control position, there is a set that enables the master agent to read the exact number of open seats left in a flight and where the flight is stored on the drum, or its "address."

Remote from the main installation are other agent sets that may perform the same functions as the local agent sets. These sets operate over a telephone pair and, therefore, may be located as far as is desired from the main storage point.

Two Digital Units

The electronic computer actually is composed of two identical digital units with the same information fed to each and the answers compared for accuracy in the cross-checking unit, Fig. 2. Not only are the answers checked (2), but timing between the two units (1) in several places is also checked. This is done to give a high degree of reliability in the answers. If a disagreement between the two units occurs, a teletype printer will print the input information and the subdivision of the equipment which caused the error. This duplication in equipment makes it possible to leave one unit in service while the other is undergoing major repairs.

The drum storage, 28 in. in length and 20 in. in diameter, is divided into

(*Continued on page* 108)

Fig. 2: Cross-checking unit compares outputs

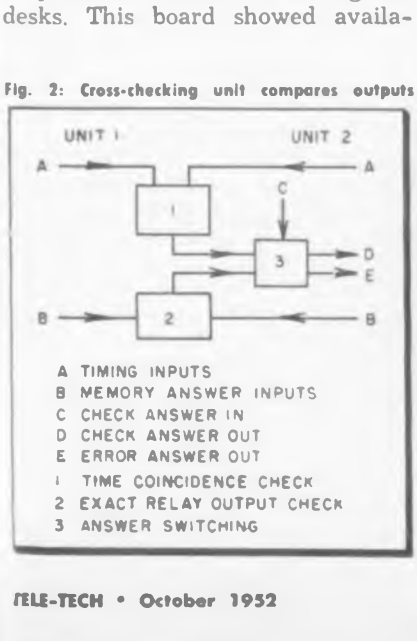
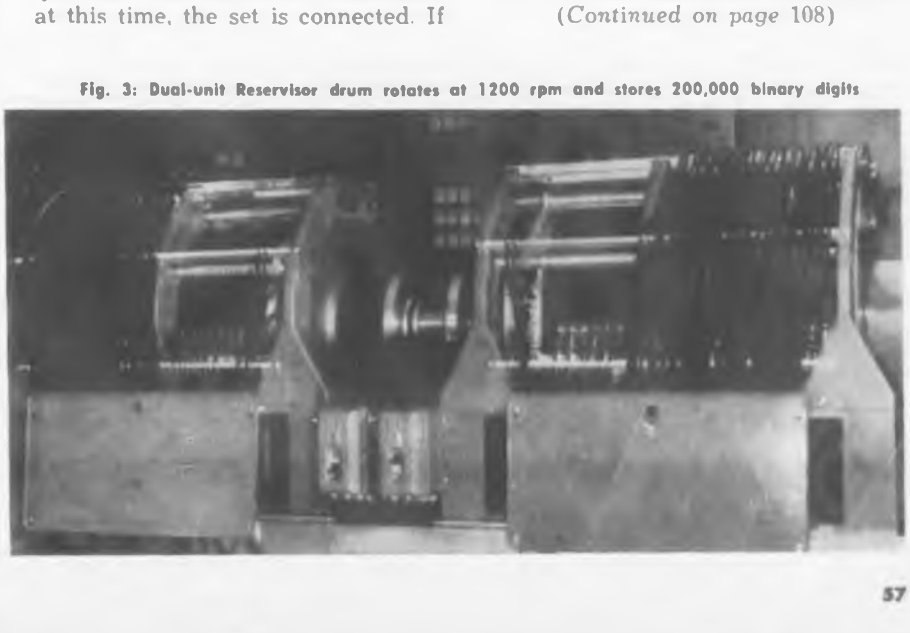


Fig. 3: Dual-unit Reservisor drum rotates at 1200 rpm and stores 200,000 binary digits



Flush-Mounted Antennas

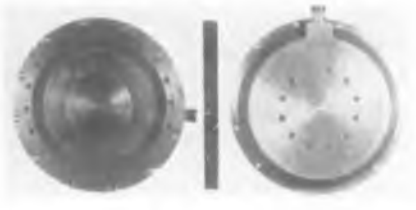
Zero-drag types developed for jet fighters and Functions include distance measuring, communica-

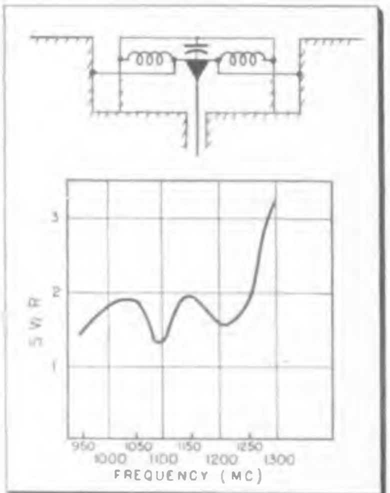
With the advent of high speed jet airplanes, the design of zero-drag, flush-mounted antennas became a necessity, and is today a basic consideration in making these installations. Presented here are representative types currently being used on military aircraft or being developed for use in the near future. With the exception of the DME Pancake and ODR antennas, which were evolved by private manufacturers, all of the units were developed at the Wright Air Development Center, Ohio. Their functions include distance measuring, communications, landing approach, interrogation and navigation.

The operating frequencies of the various antennas described here range from 100 MC for the Biconic Command antenna to 1250 MC for the Distance Measuring Pancake antenna. The coaxial feed lines are either 50 or 52 ohms, and antenna weights run from 8 oz. to 8 lbs.

DME PANCAKE ANTENNA

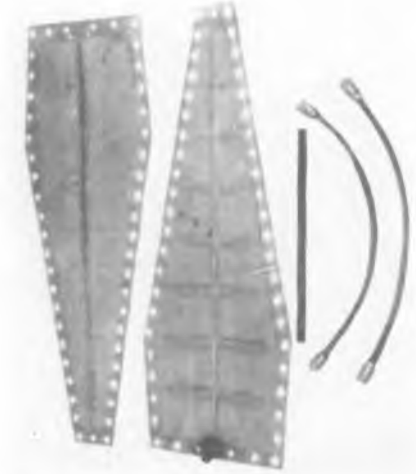
Antenna AT-234/APX is a distance measuring equipment antenna and is for use with Radar Set AN/APN-34 or similar frequency equipments. It is the latest standard flush mounted antenna for these equipments. It operates over the frequency range 950-1250 MC, is vertically polarized, and uses 52 ohm RG-8/U or similar cable for connecting the antenna to the equipment. This antenna is gasket-sealed to prevent moisture collection. Antenna AT-234/APX was designed for use on bomber, cargo, fighter and in general for most high speed aircraft.

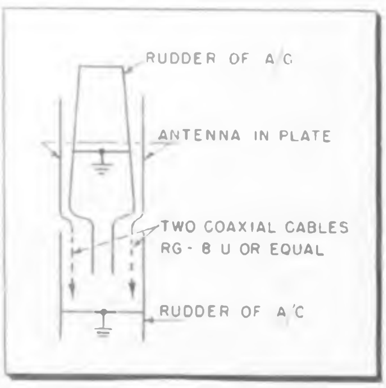




VHF HOMING ANTENNA

Dragless antenna (flush-mounted VHF Homing panels) for use with the AN/ARA-8 VHF Homing Equipment in conjunction with AN/ARC-3

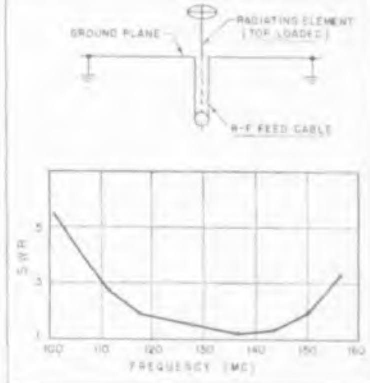




was developed in June 1945. The development of this antenna was necessitated by requirements for a low-drag article for installation on the jet type aircraft. The operating frequency of this antenna is from 120 MC to 144 MC and normally has vertical polarization. It was designed to operate with a 50 ohm type coaxial cable. The antenna panels are used in pairs. Each panel weighs 1 lb. Dimensions are: overall length, 21 in.; overall width, approximately 0.5 in.; overall depth, 12 in.; length of element, 21 in.; and width of element, 0.101 in.

PICKAX ANTENNA

The Pickax communication antenna is designed for use with the AN/ARC-3 equipment. The development of this antenna in Oct. 1944 was



necessary because of the large aerodynamic drag figure of its predecessors resulting in decreased speed and maneuverability of the aircraft. The operating frequency of this built-in antenna is from approximately 100 to 156 MC,

normally has a vertical polarization and employs a 50 ohm coaxial type cable. This antenna, described in USAF Specification No. X-7122, or one of similar configuration, is used on all Air Force aircraft of the jet series. This flush-mounted, 24 oz. antenna has the following dimensions: overall length, 13.5 in.; overall width, 2.5 in.; overall depth, 15.5 in.; length of element, 13.5 in.; and width of element, 2.5 in.

The Pickax antenna is shown mounted on the vertical stabilizer. In operation, this VHF unit is covered with a close-fitting cap.

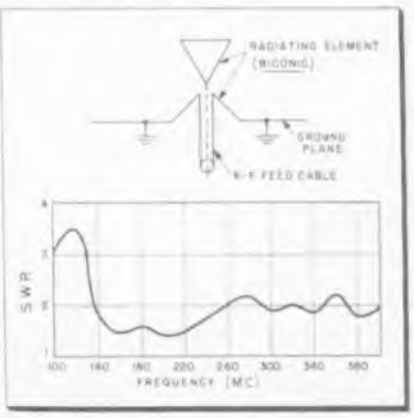
for Military Aircraft

high speed bombers cover 100 to 1250 MC range. tions, landing approach, navigation and interrogation

BICONIC COMMAND ANTENNA

This zero-drag antenna was designed for operation with the interim equipment AN/ARC-13 or its successor. This antenna was developed in the

early part of 1946 to satisfy the requirements of a broadband antenna covering the frequency range of 100 to 400 MC and could be used with the following current equipments: VHF Command Equipment, IFF Equipment, and UHF



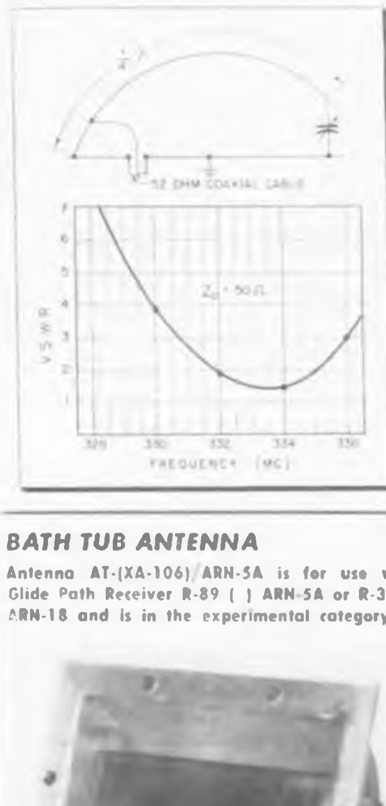
Command Equipment. The antenna was designed to operate satisfactorily inside the normal contours of jet aircraft with 50 ohm coaxial cable. It is described in USAF Specifications No. X-7074 and No. X-7172. The 55 oz. unit has the following dimensions: overall length, 15 in.; overall width, 2.5 in.; overall depth, 21.5 in. (forward-aft); length of element, 15 in.; and width of element, 2.5 in.

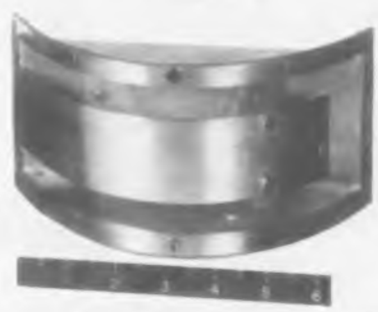
ODR ANTENNA

For a picture and description of the operating characteristics of the ODR antenna, turn to page 111

GLIDE PATH ANTENNA

Antenna AT-(XA-113)/ARN is for use with Glide Path Receiver AN/ARN-5 and R-322/ARN-18 and is in the experimental category. Requirements for dragless flush mounted antennas for high speed aircraft necessitated unusual shapes to fit the aircraft structures. The curved bath tub shape was the radical design necessary for high speed aircraft. The operating frequency is 329 through 335 MC and is horizontally polarized. RG-8/U or similar 52 ohm cable is utilized in connecting the antenna to the AN/ARN-5 receiver through a balun. Unit is described in

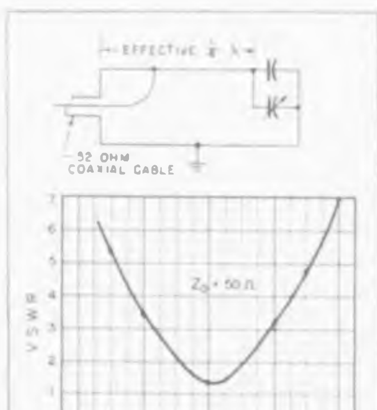




USAF Specification No. X-7196, and is particularly suitable for F-80 type airplanes. This antenna weighs 12 oz. and has the following dimensions: overall length, 7.75 in.; overall width, 4 in.; overall depth, 4 in.; length of element, 8.24 in.; and width of element, 1.75 in.

BATH TUB ANTENNA

Antenna AT-(XA-106)/ARN-5A is for use with Glide Path Receiver R-89 ( )/ARN-5A or R-332/ARN-18 and is in the experimental category. It



is generally similar in application and design to the AT-(XA-113)/ARN. The operating frequency is 329 through 335 MC, horizontally polarized. For connecting Antenna AT-(XA-106)/ARN-5A to the receiver, 52 ohm, RG-8/U cable is utilized. A balun is required for connection to Receiver R-89 ( )/ARN-5A. Depending on the mounting surface, the 8 oz. unit has zero drag. Its dimensions are: overall length, 6.75 in.; overall width, 4.25 in.; overall depth, 2.25 in.; length of element, 4-29/32 in.; and width of element, 1.25 in.

High-Power

Linear amplifier delivers 15 kw with over 23 db gain in 470-890 mc band. Demountable cathode-filament assembly permits inexpensive replacement

SEVERAL high-power klystrons have been produced and are seeing service in the 1000 MC region. These include the V-25 operated at 1036 MC by the National Bureau of Standards on Cheyenne Mountain, Colo., and delivering 5 kw, and the X-16 which forms a part of the General Electric TV transmitter announced last year.

By extending and refining the techniques utilized in those tubes, Varian Associates, San Carlos, Calif., has developed the V-42 (Fig. 1) which delivers 15 kw with at least 23 db gain over the UHF TV band and is 30% efficient. Bandwidth of the tube is 6 MC between the 1 db points. Tuning means are included to permit adjustment at least 4% either side of the factory-established center frequency. This is accomplished by stretching or compressing the individual resonators, using the locking nuts visible on the side adjusting studs in Fig. 1.

Electrical specifications for the V-42 include a dc beam voltage of 17 kv maximum at 3 amp between cathode and catcher; a dc bombarder voltage of 2400 v. at 0.5 amp between cathode and filament; and an ac filament voltage of 7 v. at 35 amp. The electron beam is collected in a water-cooled catcher requiring a 10-gpm flow at 50 psi while the cathode-filament assembly is cooled by forced air. Having a length of 50 in., the tube weighs 150 lb. without the 100-lb. beam-focussing magnets.

Like the earlier tubes, the V-42 has a demountable cathode-filament assembly designed to permit inexpensive replacement. A cross-section (Fig. 2) through this assembly shows its construction, based on rigid shock- and vibration-insensitive concentric cylinders. The filament is a flat spiral of pure tungsten located behind the dished circular tantalum cathode. The bombarder voltage established between filament and cathode produces electron bombardment of the cathode—in the nature of diode operation—heating the tantalum to an emitting temperature. Cathodes of this type give long trouble-free service limited generally only by failure of the filament from evaporation of the tungsten.

This factor is made even more favorable by operating the filament with enough undervoltage to limit temperatures to a point where operating life expectancies of over 10,000 hours can be attained. Upon failure, these tubes can be returned to the factory for economical replacement of parts or of the entire cathode structure. Tantalum cathodes have the advantage that they do not lose their emissivity by poisoning when tubes are exposed to air during such overhaul operations.

Inherent Advantages

In general, klystrons have a number of inherent advantages for application to services of this kind. Due to configuration, the cathode is located outside of the r-f field and far from it by comparison with conventional negative-grid electron tubes. This makes it relatively easy to develop the large-scale source of electrons required for high-power operation and, at the same time, permits use of an ac filament without creating hum difficulties in the signal regions. Also, since current drain from the power supply is independent of r-f level, a regulated or low-impedance source is not required to accommodate modulation peaks. Power-supply ripple presents the most likely problem of spurious modulation, but even the most simple filtering will carry this down better than 60 db below the carrier.

Linearity in a klystron is also a point of advantage. Output varies with input as a Bessel function of the first order and first kind. Consequently, output voltage across the load rises to a maximum and then, as excitation increases, falls again —eventually to zero. The first portion of this curve is used as shown in Fig. 3. For low levels, the curve

Fig. 1: Varian's V-42 klystron may be tuned to 4% of factory-set frequency by compressing or stretching resonators with locking nuts

UHF Klystron

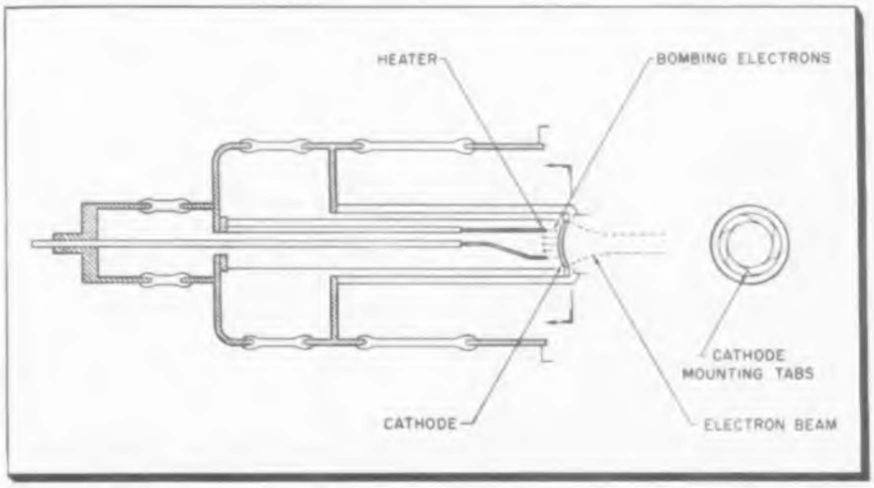


Fig. 2: Cross-section shows demountable cathode structure. Hatched areas are Kovar, clear areas glass

is extremely linear and does not deviate appreciably until about 80% of maximum power. Thus the TV picture signal is undistorted throughout the video region up to the black level. The remaining part of the curve up to full power is used by synchronizing pulses and the nonlinearity is easily accommodated by predistortion or stretching in video circuits ahead of the klystron stages.

No Partition Noise

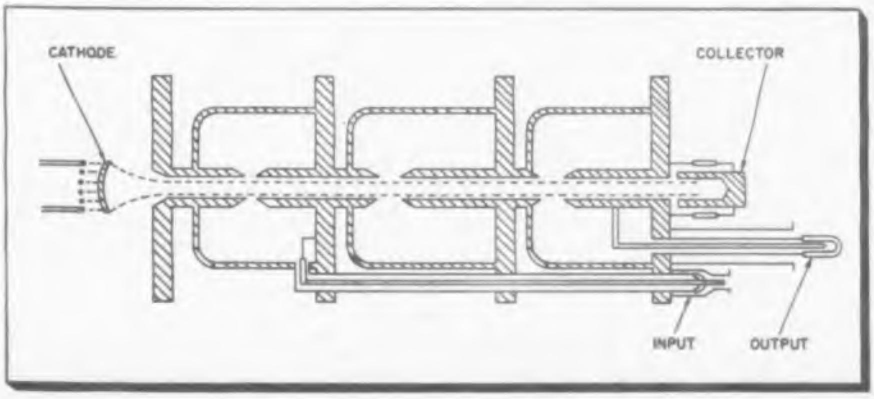
From a random noise point of view, there is no partition noise to contend with because there are no grids. In physical and electrical arrangement, these klystrons constitute complete final amplifiers including their own integral tank circuits.

Both safety and water-supply considerations are furthered by the arrangement of the 10 gpm, recirculating collector cooling system in the V-42. The collector is insulated from the body of the tube by a glass seal so that current lost to the drift tube and reaching the collector can be metered. Because the cathode is operated below dc ground potential, both the collector and tube body are at ground. Besides giving maximum protection to operating personnel, this arrangement obviates electrolysis and insulation difficulties.

Fig. 4 shows the physical configuration of a cascade klystron of the V-42 type. The stream of electrons arising in the cathode is directed down the center of the drift tubes shown, being focused by the external electromagnets. R-F interaction with this beam is accomplished in the cavity-resonators, the first of which is excited by the drive which is brought in through the input connection at the top of the tube.

In cascade or triple-resonator klystrons, the first stage can be compared with a voltage amplifier, while the stage between the second and third resonators performs as a power amplifier. When the input r-f

Fig. 4: Internal arrangement of cascade klystron. Flexing thin resonator walls permits tuning



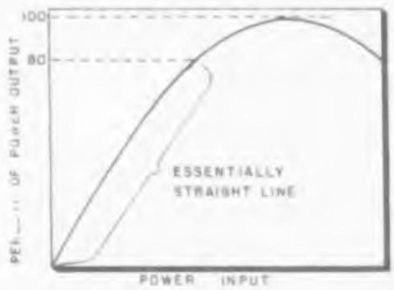


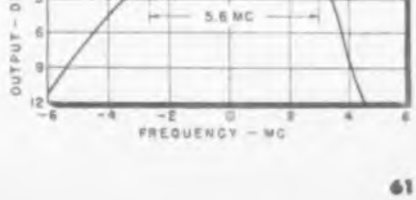
Fig. 3: Bessel function curve of klystron output vs. excitation voltage. Video signals are held within linear left section of the curve

signal excites the first resonator, electrons in the beam are bunched or velocity modulated, thereafter traveling in groups or concentrations. As these bunches pass the succeeding resonators, some of their energy is transferred to these circuits in such a way that useful power can be extracted through the output connection, also brought out the top of the tube. Because energy supplied by the beam current and the collector voltage appears in this output, it is greater than the input and amplification takes place.

Complete isolation between output and input circuits is achieved because pure electron coupling exists. Thus, very high gain is obtained without the need for neutralization. The response curve is shown in Fig. 5. Power gain corresponding with this curve is about 24 db. Bandwidth of a cascade klystron is about the same as that for a single-stage tube, and can be exchanged for gain by either loading the resonators to reduce their Q or by stagger tuning, the latter generally being preferable. The stagger-tuning scheme used requires no loading of the center resonator.

For power-measuring operations, Varian engineers have developed a new coaxial water load which can be supplied for installation with these tubes so required FCC output readings can be secured quickly and accurately. The unit consists of a 6-ft. length of $3\frac{1}{8}$ in. diameter line with water connections and two thermometers—one to read incoming water temperature and the other outgoing. Electrically, the new load has an extremely low vswr of 1.1 or better from 470 to 1200 MC.

Fig. 5: Response curve for Varian V-42 klystron shows the 6 MC bandwidth between 1 db points



Techniques for Photo-

Particularly suited for experimental and
cil is prepared and attached to screen.

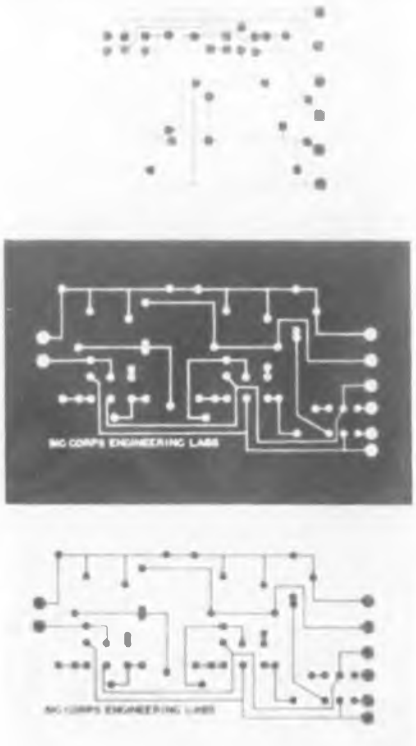


Fig. 1: Printed circuit transparencies. (t) Drawing on frosted acetate using photo opaque. (c) Negative transparency using photo resist. (b) Positive transparency for screen stencil

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SILK screen printing is a process whereby a print is deposited on a surface by forcing paint through the open areas of a stencil affixed to a fine mesh silk cloth. Such silk screen printing covers a broad field of applications ranging from the simple printing of decorative patterns on textiles, to printing conductive paints and etchant resists for printed electronic circuits.

The stencil for the screen may be prepared in several ways, but for the printed circuit applications being considered this stencil can be prepared most conveniently by a simple photographic procedure. The hand manipulation of the screens in printing could well be replaced by screening machines for large production; but, regardless of the degree of mechanization, the same basic principles apply. Accordingly, this article deals with the photographic preparation of the silk screen stencil and with the practical details of the art of screen printing.

As a first step in the preparation of the film type stencil, a positive transparency (black line pattern on transparent plastic base as shown in Fig. 1) is required. These transparencies may be photographic positives or may be hand drawings made with photo opaque on frosted acetate.

The hand drawn type of transparency is especially suited for laboratory work since it may be quickly prepared using only common drafting equipment and techniques. This type of transparency may also be very easily altered or replaced if circuit changes are desired. The black line circuit pattern should be opaque or dense enough to block out the light under exposure.

Taping of the transparency is recommended to provide a "safe edge" on the stencil film. This safe edge will prevent the edge separation of emulsion from the backing during subsequent washing.

During exposure, the areas of the gelatin emulsion on the silk screen film which are exposed to the direct light through the positive transparency are hardened slightly and rendered insoluble in water, while those areas which are protected by the opaque lines of the positive transparency remain water-soluble. The film is allowed to soak in water, in the course of which the unexposed portions of the stencil soften and eventually wash out. The film is then mounted on the screen completing the stencil.

All steps in the preparation of a photographic silk screen stencil may be performed in daylight but working in a strong direct light is not recommended.

Silk Screen Film Sensitizing

The use of photographic silk screen film for the stencil permits the printing of the finest detail possible by the silk screen process. One type of commercial film for this purpose consists of a heavy coating of dyed gelatin on a translucent plastic backing. The film as received is not light sensitive and so must be treated with a sensitizer, made by dissolving 20 grams of potassium bichromate in one pint of water. Since this sensitizer will deteriorate with age and exposure to light, it should be kept in an opaque container (or a brown glass bottle) and renewed monthly.

The initial step in the preparation of the film is the cutting of a piece of film that is at least 1.5 in. larger in both dimensions than the desired stencil. This film is taped smoothly along its outer edge, emulsion side up, to a piece of stiff cardboard (Fig. 2). The sensitizer is applied with a 2 or 3 in. soft camels-hair brush and must be cross-brushed carefully to prevent air bubbles, wrinkles, and streaking (Fig. 3). The next drying step may be done in the open air using a fan, or in a circulating air oven with the heat turned very low. For best results, a constant temperature of 80° to 85 F is desirable together with a relatively low humidity (about 50%).

When the film surface is dry to the touch, it is ready for use and should be used within a few hours. Film not used within 8 to 12 hours should be discarded because the film hardens and will not wash out. The film is removed from the cardboard by cutting the film free just inside the taped edges.

Exposure

A vacuum frame (commercial printer which presses transparency and stencil together) with an arc light is the ideal combination for exposing the film. A contact printer (as shown in Fig. 4) with a strong light source is adequate. During exposure the light must pass first through the back of the transparency and then through the back of the film. Not exposing through the back of the film is the most frequent mistake in stencil making. The order of set-up (using a vacuum frame) would be as follows: First, place the film on the rubber base, emulsion side down; then place the positive transparency over the film, face down; and then close the frame. Using a 20 ampere double arc light at a distance of 30 in., the exposure would be 45 to 60 seconds; or using a #2 photo-flood bulb at a distance of 16 in., the exposure would be 50 to 70 seconds. The film will tolerate up to 50% variation in

graphic Silk Screen Printed Circuits

small-scale production, detailed methods show how sten-
Set-up and operation of printing process is described

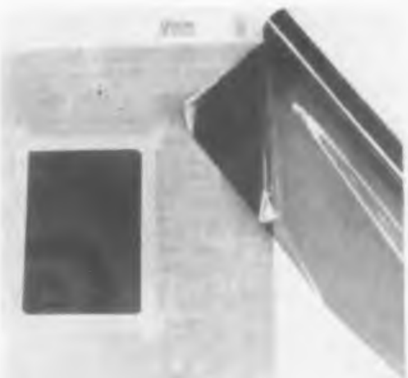


Fig. 2. Before sensitizing, silk screen photo stencil film is taped to a stiff backing

Fig. 3: Sensitizer is applied to film with a very soft camel hair brush, and then dried

Fig. 4: Contact printer used to expose sensitized stencil film to pattern on transparency

Fig. 5: Stencil is affixed to screen by bringing mesh down on stencil, pressing with paper

Fig. 6: Register guides are fastened to the printing base to locate successive base pieces

Fig. 7: Printing medium is poured at end of masked stencil and spread with rubber squeegee

exposure but it is recommended that test strips be made to determine the best exposure time.

Washing

After the film has been exposed to light, it should be washed immediately. This may be done by placing the film face down in a large flat developing tray filled with water at approximately 110° F. After being allowed to remain face down on the surface of the water for approximately 30 to 45 seconds, the stencil film is turned face up and agitated gently beneath the surface of the water until the stenciled circuit pattern becomes clear. The film may be removed from the water and held to the light for inspection. Washing must continue until there is no trace of dye coloring in any of the lines of the patterned circuitry. The film then is given a second washing in cold water.

Transfer of the film stencil to the silk screen is done immediately after the second washing while the stencil is still wet. The finest definition may be obtained by placing the stencil on a screen of silk of about 150 mesh in such a manner that most of the lines of the patterned circuitry run at 45° angle to the mesh of the silk stretched taut on the screen frame hinged to a masonite-type base.

The stencil is affixed to the screen by placing the stencil face up on the printing base and bringing the screen down with the silk mesh covering the stencil. A clean smooth absorbent paper (newspaper will do) is then laid over the surface of the silk and rubbed gently (Fig. 5). The blotting action of the paper draws the stencil into the mesh of the silk. The screen must not be moved until the stencil is partly dry which usually takes about 30 minutes. The screen may then be raised and allowed to dry thoroughly and the stencil film backing peeled off. Blocking-out lacquer may be used to retouch any holes or unwanted lines in the stencil.

Printing

The silk screen stencil described herein may be used for either printing an etchant resist paint pattern or for depositing a conductive pattern using silver conductive paints. The screening operation itself consists of wiping a liberal

(*Continued on page* 94)

Preview of New Equipment at

Latest developments featured by more than 75 companies at 8th annual

Tubular Twin-Lead (61)

Type 14-271 Amphenol tubular twin-lead maintains constant impedance, almost totally unaffected by weather conditions, and is par-

ticularly suitable for UHF-TV. Nominal impedance is 300 ohms and velocity of propagation is 84%. Attenuation in db/100 ft. is as follows: 30 MC. 0.63; 60 MC. 0.93; 100 MC. 1.25; 200 MC. 1.82; 400 MC. 2.7; 500 MC. 3.0; 700 MC. 3.6; and 900 MC. 4.2. List price is $.08/ft., and in lengths of 100, 500 and 1000 ft. The price is $7.93, $35.38, and $68, respectively.—**American Phenolic Corp., 1830 S. 54th Ave., Chicago 50, Ill.**—TELE-TECH

TV Chain Amplifier (102-103)

Model 212TV chain amplifier has two-stage wideband circuit which amplifies all TV channels from 40 to 225 MC simultane-

ously without tuning or switching. Ideally suited for TV distribution systems, it has voltage gain of 21 db, maximum output voltage of 6 v., and a response characteristic of ± 2 db, with less than a 0.7 db variation over any TV channel. Intermodulation distortion with 0.5 v. rms output signals is 11 mv rms or —39 db. Harmonic distortion is 2.2% for the second, 0.05% for higher harmonics. The 12-lb. amplifier uses twelve 6AK5's, is available with input impedances of 180, 72 and 52 ohms, and output impedances of 235, 72 and 52 ohms. Power consumption is 55 watts, 117 v., 50-60 cycles. —**Spencer-Kennedy Labs., Inc., 186 Massachusetts Ave., Cambridge 39, Mass.**—TELE-TECH.

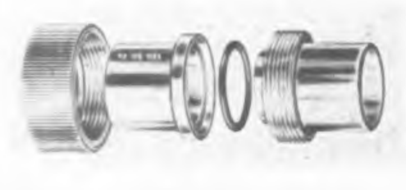
Diffraction Loudspeaker

Model 848 Compound Diffraction Projector Speaker System for public address provides 20% increase of articulation index for speech reproduction and $2\frac{1}{2}$ octaves increased range for music. Weatherproof construction provides greater sound dispersion

and efficiency. It utilizes two coaxially mounted horns working from opposite sides of a single diaphragm. Each horn is designed for optimum reproduction within its own range, providing response of ± 5 db to 11,000 CPS. Low end response is augmented by 100 CPS horn taper. System delivers $2\text{-}2\frac{1}{2}$ octaves more range than usual PA units. Polar distribution pattern exceeds 120° at all frequencies up to 5000 CPS. It is molded of glass fibers and edgewise-wound voice coil assembly uses durable phenolic impregnated glass cloth diaphragm. Rated at 25 watts, 16 ohms, 12-lb. projector is 10.5 x 20.5 x 20 in. List price is $59.—**Electro-Voice, Inc., Buchanan, Mich.**—TELE-TECH

Vacuum Coupling (60-B)

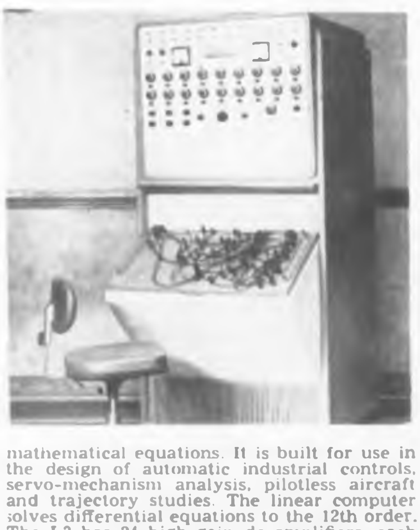
No. 94235 vacuum coupling, Cenco Type "CHV", for joining tubular elements in a vacuum-tight system assures maximum con-



ductance of system by the elimination of any constriction in the bore of the coupling. Union is made by hand-tightening a knurled nut which compresses the "O" ring until metal-to-metal contact is reached. Compression is limited to provided maximum life of "O" rings. Coupling fits standard tubings of steel, stainless steel, copper, etc. Permanent connection to the tubular elements may be made by soldering, brazing, or welding. Made in seven sizes from $\frac{1}{4}$ to 2 in. OD, unit costs range from $3.55 to $14.35. Similar $\frac{1}{2}$ in. coupling with release valve is available for metal-to-glass connection.—**Central Scientific Co., 1700 Irving Park Rd., Chicago 13, Ill.**—TELE-TECH

Differential Analyzer (5-6)

L3 GEDA electronic differential analyzer is capable of solving problems of motion and control either by direct simulation or by



mathematical equations. It is built for use in the design of automatic industrial controls, servo-mechanism analysis, pilotless aircraft and trajectory studies. The linear computer solves differential equations to the 12th order. The L3 has 24 high-gain dc amplifiers, each with four stages of amplification to give a gain of 200,000. Continuously self-balancing circuit maintains amplifier balance to within 250 μv of zero equivalent input. Calibrated plug-in turrets set equation constants. Turrets are supplemented by 18 to 36 potentiometers, permitting the independent setting of 72 to 165 parameters. Complement of 131 tubes contains eight types for easy servicing. Amplifiers used are characterized by wide bandwidth, low grid current and zero drift. —**Goodyear Aircraft Corp., Akron 16, Ohio.** —TELE-TECH

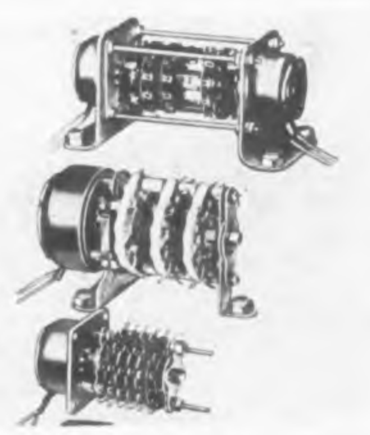
Wheatstone Megohm Bridge (83)

Utilizing a Wheatstone bridge in conjunction with a highly stabilized dc amplifier, Model 635-A direct-reading instrument pro-

vides accurate measurements through range of 10 ohms to 1,000,000 megohms. Accuracy is ± 1% from 10 ohms to 10 megohms, ± 2% from 10 megohms to 10,000 megohms and ± 5% from 10,000 megohms to 1,000,000 megohms. A built-in electronically-regulated power supply provides different voltages for both high and low ranges. Oversize solid-silver contacts in Steatite-insulated switch decks maintain long-life accuracy over a wide temperature range.—**Shallcross Mfg. Co., Collingdale, Pa.**—TELE-TECH

Circuit Selectors

Ledex circuit selectors and stepping relays are used for remote control of multiple circuits. They are operated by rotary



solenoids, have positive detent action and are self-stepping or external pulsing. Choice of wire sizes permits wide range of operating voltages. Solenoids are available in diameters from $1\frac{1}{8}$ to $3\frac{3}{8}$ in. with predetermined rotation up to 95°. Starting torques for 45° stroke range from 0.25 to 50 lb.-in. DC solenoids weigh from $\frac{1}{8}$ to 4.25 lbs.—**G. H. Leland, Inc., 123 Webster St., Dayton 2, Ohio.**—TELE-TECH

Ponogometer (91)

Type 394-A ponogometer monitors contact resistance between potentiometer resistance element and contact. Indication is of the Go-No-go type. Threshold resistance is adjustable from 10 to 5000 ohms. Since con-

National Electronics Conference

meeting in Chicago's Hotel Sherman, Sept. 29 through Oct. 1

stant specified value of current is passed through slider contact resistance, knowledge of noise voltage is obtained. Instrument indication is independent of total resistance or angular position of slider from 0 to 100,000 ohms. Power requirements are 40 watts, 105-125 v., 60 cycles. Sensitivity is independent of slider speed from 1 to 60 rpm. Recovery time is less than 1.5 seconds. Nine-tube unit weighs 7.5 lbs., and measures 13¼ x 6⅛ x 9¾ in.—**Technology Instrument Corp., 531 Main St., Acton, Mass.**—TELE-TECH

VHF Klystrons (58-59)

Type 4W20000A (1) 20-kw radial-beam power tetrode for VHF-TV is water-cooled and features a unipotential cathode of thori-

ated tungsten heated by electron bombardment. The water-cooled anode is rated at 20 kw dissipation, and has coaxially arranged terminals. Eimac Type 4X2000A 20-kw radial-beam power tetrode for VHF-TV is air-cooled and all the special characteristics of the water-cooled tube, including a ceramic envelope for greater mechanical strength and higher resistance to thermal shock. Integral contact fingers assure proper terminal contact and simplify circuit construction.—**Eitel-McCullough, Inc., San Bruno, Calif.**—TELE-TECH

X-Y Recorder (92-93)

Speedomax X-Y recorder has two separate electronically-balanced measuring circuits in one case, enabling it to plot the relationship between two interdependent variables. The X function is shown in the pen movement across the chart. The Y function is the vertical movement of the chart paper. Other recorders are a high precision instrument for temperature measurements

BOOTH NUMBERS at which the equipment described will be on display in the Hotel Sherman are indicated by the numbers in parentheses

and a versatile unit having a continuously adjustable zero and range suppression which can be used for a wide variety of applications.—**Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia 44, Penna.**—TELE-TECH

Welding Analyzer . (106-107)

Model BL-213 new direct writing welding analyzer records single-phase and three-phase resistance welding machine variables. Welding current and electrode force are measured and recorded simultaneously, and show the important squeeze, weld, hold, and

off-time intervals. It also records the small 180 CPS component present in machine current when ignitron rectifiers are used. This analyzer consists of the modified Model BL-202 dual channel oscillograph, a modified Model BL-932 dc amplifier, and BL-320 universal amplifier. The modifications enable the analyzer to record 180 CPS for three-phase timing purposes. The operating variables of resistance spot, projection, and seam welding machines can also be accurately recorded.—**Brush Development Co., Instrument Div., 3405 Perkins Ave., Cleveland 14, Ohio.**—TELE-TECH

Waveguide Standards (46)

Waveguide vswr standards for precision tests are available in all military sizes from 1 x 0.5 to 3 x 1.5 in. Reference sections have a vswr of 1.00. Standards having a mismatch at the input flange when mated with

the nominal guide or system under test of 1.05, 1.10, and 1.20 are obtainable. Inherent vswr is produced by milling narrow guide dimension less than that of mating guide to yield required mismatch. Broadband standards require no tuning. Units feature rugged, very flat sliding load, included with each set in a carrying case.—**Airtron, Inc., 20 E. Elizabeth Ave., Linden, N. J.**—TELE-TECH

For More Previews
to be
of New Equipment to be exhibited at the National Electronics Conference, turn to pages 78, 80 and 82.

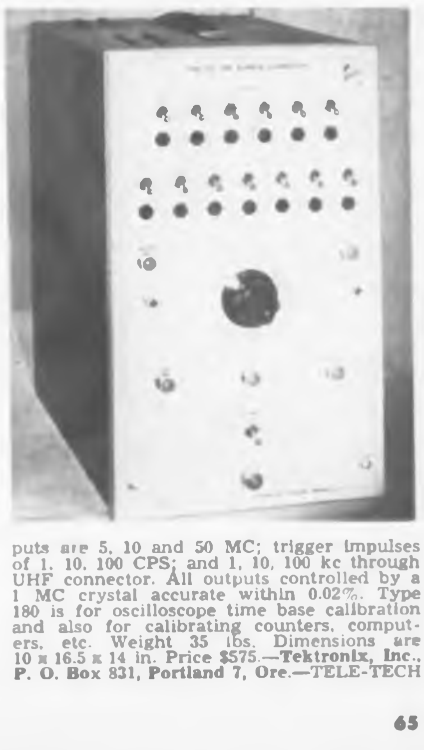
Audio Oscillator (112-113)

Model 200AB audio oscillator covers 20 CPS to 40 KC in four ranges. Power output is 1 watt or 24.5 v. Load impedance is 600 ohms, distortion is 1%, and power consump-

tion is 60 watts. Large vernier dial gives long calibrated scale. Frequency stability is ±2%, including warm-up, and hum voltage is less than 0.1% of rated output. Price is $150. Also shown are the Model 618B signal generator, covering 3800 to 7600 MC with a variable output from 0.223 v. to 0.1 μv., selling for $2250; and Model 522B electronic counter, covering 10 CPS to 100 KC, with a time interval range of 10 μsec to 100,000 seconds, sellings for $900.—**Hewlett-Packard Co., 395 Page Mill Rd., Palo Alto, Calif.**—TELE-TECH

Time Mark Generator

Type 180 time mark generator has the following features: time markers of 1, 5, 10, 50, 100, 500 μsec; 1, 5, 10, 50, 100, 500 milliseconds; and 1 second, all available separately and simultaneously. Since wave out-



puts are 5, 10 and 50 MC; trigger impulses of 1, 10, 100 CPS; and 1, 10, 100 kc through UHF connector. All outputs controlled by a 1 MC crystal accurate within 0.02%. Type 180 is for oscilloscope time base calibration and also for calibrating counters, computers, etc. Weight 35 lbs. Dimensions are 10 x 16.5 x 14 in. Price $575.—**Tektronix, Inc., P. O. Box 831, Portland 7, Ore.**—TELE-TECH

"Trans-Atlantic Television"

The White House and TELE-TECH's readers express varying views on proposals advanced in our editorial on page 33 of our August issue

From The White House

Consideration has been given to your letter to the President concerning the desirability of having an inter-continental television service and creating a Government sponsored committee to consider the possibilities.

Insofar as the Government's requirements are concerned, it is felt that no need exists for the appointment of a technical committee for this purpose. Existing committee structures within Government are believed to be adequate. The President is of the opinion that the electronic and communication industries are best equipped to carry on such studies and that the television industry could well sponsor such studies upon its determination that such a project is timely.

A substantial amount of work has been done over the past few years toward the reconciliation of differences in the technical standards in various countries. The United States with the help of the nation's television industry has participated in this work actively and constructively through the International Radio Consultative Committee of the International Telecommunication Union, which has a special Study Group that maintains a continuing effort on this subject.

JOSEPH SHORT
Secretary to the President
The White House
Washington, D. C.

Many Benefits from International TV

Your letter addressed to President Truman on "Trans-Atlantic TV" is most interesting and, in my opinion, most worthy in purpose. When, as and if such a TV link is accomplished, it would most certainly be the most practical means of bringing about better understanding between the peoples of foreign lands and ourselves.

Perhaps it is only a matter of viewpoint, but I believe that the people in our country have a much better and much more objective point of view with regard to world affairs and world relationships than do our brothers across the seas. We have many things to show that will be amazing to them and, of course, extremely educational. We, too, can learn much from telecasting in foreign lands. The objectives which would be accomplished by this means of communication would be of so great a value that the cost of such a line undoubtedly would be justified.

It occurs to me also that, inasmuch as the European countries are looking for items to manufacture which not only could be consumed by their own population but which, also, could be used as a medium of exchange through export, television manufacturing would absorb much labor and be an important aid in the building up of their economies.

Please advise if there is anything that RTMA can do to cooperate with you in this worthy cause.

A. D. PLAMONDON, JR.
Chairman, RTMA Board of Directors
President
Indiana Steel Products Co.
Valparaiso, Ind.

He Sent Pictures Across Atlantic in 1926!

I agree wholeheartedly that Trans-Atlantic TV is a must; and where that is so, the answers are bound to come.

When we first sent facsimile pictures across the ocean in 1926, it was a case of sizing up all the available factors and combining them in the way that produced the results, which have become quite routine now in the transmission of news pictures and weather maps. Somewhat the same approach must be given this TV spanning of the ocean.

Down at Orlando, Fla., during the last War, we were given the job of contacting low-flying planes from the ground. We tried every available wave length and antenna but could not reach forward to them beyond 25 miles. Then we sent up a VHF relay plane to a height of 8,000 ft. and had no difficulty in reaching these ground hoppers some 250 miles out front. The Westinghouse Company has of course since applied this technique to TV relaying.

For immediate events such as the coming Coronation, it would seem that this extended relay-plane method is the practical answer. Ten of them should certainly succeed in spanning the Atlantic.

But for the steady operation, a series of ground stations up around the Greenland route seems right, although the number suggested of 68 is rather appalling. Perhaps multiplexing and thus reducing the individual channel band width may make is possible to extend each link and thus reduce their number

It is certainly an intriguing challenge, which I am sure will be met.

R. H. RANGER
President
Rangertone, Inc.
73 Winthrop St.
Newark 4, N. J.

Trans-Atlantic TV Far too Costly

While it is no doubt technically possible to establish some form of relay which would permit trans-Atlantic TV, the cost of such an operation would appear to be far out of proportion to the use which would be obtained therefrom. The great news events of Europe can be brought into American homes by way of film with very little delay and the few happenings sufficiently newsworthy to warrant immediate viewing hardly seem worth the effort.

Likewise, the underprivileged of Europe will no doubt have readier access to motion picture theaters than they will to television sets. Further, it is possible to edit the motion picture whereas some of the current TV live programming might not be suitable for the underprivileged, or for that matter, for he privileged.

In fact, I am not persuaded that Europeans are especially interested in our "Voice of America." They are subject to so much propaganda from all sides that they undoubtedly mistrust our own.

In my opinion the funds needed to get fast action on trans-Atlantic TV would be far better employed in reducing the national debt.

FRANK G. KEAR
Kear & Kennedy
Consulting Engineers
1302 18th St., NW
Washington, D. C.

Advantages of VHF-Microwave-Relay Plan

I was pleased to note that you have given your support to Trans-Atlantic TV. From the observations I have made, a great deal of support is required to put it across. Apparently, at the present time, there are very few who accept its possibility.

Of the various systems which have been proposed in the past few years, I believe the system proposed by William S. Halstead, Research Associate of Crosby Laboratories, Inc., has the greatest practicability. Mr. Halstead proposes a microwave and VHF relay chain up the east coast of United States and Canada across to Greenland, then to Iceland, the Faeroe Islands, Shetland Islands and England. The maximum distance between relay points which this route would call for, is 290 miles. It is proposed to cover these longer distances by superpower on VHF. Superpower transmitters would be used in conjunction with a super directive antenna to span the distances by brute force. If this method fails, the inclusion of coaxial cable and relays on anchored ships is proposed for the several long over-water distances.

This microwave relay plan of Mr. Halstead's appears to me to be much more feasible than the other systems proposed. The "scatter transmission" proposal involves signals reflected from layers of the ionosphere with the great possibility of multipath effects which would not allow good transmission of television. The express-plane ship-relay, and coaxial cable all have the limitation of an exceedingly high cost and limited service capabilities.

Mr. Halstead conceived this plan in 1946, and only recently was successful in gaining acceptance in engineering and management circles. The plan apparently so staggers the imagination that it is difficult to accept. However, if one considers the results which might be accomplished by the system, justification seems to be easy. I look upon such a relay system not only from the standpoint of providing inter-continental television transmission, but from the standpoint of the other communication facilities which it could provide in addition. The congestion of the short wave communication channels is now so great that it is time for some revolutionary steps such as this microwave VHF relay to provide a relief. After such a system is provided, the short wave channels may be reallocated to types of service such as marine where long distance transmission is a necessity. One microwave communication channel having a bandwidth sufficient to accommodate a television picture, would undoubtedly handle sufficient telephone and telegraph channels to carry on all of the communications now handled in the complete frequency range from 3 to 30 MC. Furthermore, such a microwave channel would be far more dependable and accurate due to its freedom from fading effects, static, magnetic storms and other effects which plague short wave transmission. It would also be more free from intentional jamming.

MURRAY G. CROSBY
President
Crosby Laboratories
Robbins Lane
Hicksville, N. Y.

Many Uses for NARCOM Relay System

Your editorial "Let's Get Action on Trans-Atlantic TV!" in the August issue of Tele-Tech is, in my opinion, an interesting and forceful presentation of the idea that television is emerging in the international field as a powerful new communication tool. It is clear that this medium has limitless potentialities in unifying and strengthening the peoples of the free world.

As an open letter to the President, it is to be hoped that the editorial will aid in directing the thought of our political and military leaders to full appreciation of the immense significance of television and related wide-band telecommunication developments in furthering the two-way exchange of ideas and information of all types between the continental areas of North America and Europe.

With respect to the various proposals for attaining transmission of TV signals across the Atlantic, it is of importance to emphasize several factors that were not mentioned in the editorial but which have a direct bearing on the subject:

(1) It is intended that the proposed North Atlantic Relay Communication System, known as the NARCOM plan, will utilize a chain of microwave and VHF relay stations in carrying several hundred telephone, teletype, and facsimile channels, in addition to international TV and radio broadcast services. These general telecommunication facilities, which should be of very substantial value to international business, the news agencies, and governmental organizations, including the military forces of NATO countries, will provide a sound economic basis on which the relay system will be constructed and operated. Later, when international TV and radio broadcast networks have developed fully it may be expected that revenue from these services will form a large part of the total income of the relay system.

(2) By concentrating radio wave energy in narrow beams along the chain of relay stations at strategic mountain-top locations on the natural bridge of islands between the two continents it will be possible to effect great economy in frequency utilization, a factor of vital importance at this time, as well as improved operational efficiency and security. In event of hostilities, the relatively small number of relay stations should enable

adequate defensive measures to be taken at each relay point, thereby protecting the entire system. With coaxial-cable systems, on the other hand, the communication facility is vulnerable to enemy action at an infinite number of points.

(3) When future demands for expansion of facilities are encountered, or when it is desired to add multiple channels to accommodate the super-speed record transmission media such as Ultra-Fax, it will be a relatively simple matter to install the necessary relay equipments at each station to provide additional wideband channels. In this respect, it should be noted that radio-relay methods possess inherent advantages over coaxial-cable systems, in which duplication of cables throughout their lengths, including all their associated amplifiers, is required in adding wideband channels to meet increased service demands.

(4) The NARCOM route, as proposed, will cut across one of the most important areas of the world as seen from a military defense viewpoint. Observation of a polar-projection map of the North Atlantic area and the region within the Arctic Circle will show that the shortest air route between Soviet air bases in the western sector of the USSR and the east coast of the United States passes over a large part of the NARCOM relay route between southern Greenland and the Middle Atlantic states of our country. Because the unobstructed elevations at the mountain relay stations in this important area offer advantages with respect to operation of long-range radar and associated VHF air-defense communication systems, it is anticipated that many benefits will be obtained in the event that supplementary equipment of this type is installed at the relay station sites. Moreover, the presence of wideband communication facilities at these locations, with connections to master control centers, should be of material aid in coordinating radar network and air-defense operations.

(5) Preliminary estimates of the cost of the NARCOM project now vary over a considerable range, and will depend in large part on the number of communication channels, bandwidths, and other circuit requirements. Engineers associated with international communication companies now giving their support to the NARCOM plan have made informal estimates that range between $50,000,000 and $100,000,000. While these figures may appear excessive for any single communication system, we should give thought to the many benefits that will stem from the multiple services that will be made available to the various countries of the entire North Atlantic area. Further, when it is realized that the cost of a single ocean liner, the "United States," was approximately $78,000,000, the estimated costs of the NARCOM system appear in proper perspective.

WILLIAM S. HALSTEAD
Research Associate
Crosby Laboratories
25 Vanderbilt Ave.
New York, N. Y.

Problem Should Be Explored, Now!

Congratulations on the quality of creative imagination and foresight displayed in your August proposal for the investigation of Trans-Atlantic TV. I believe that the history of human social development will support the contention that an improvement in effective communications in a community influences the pattern of community life away from isolation and conflict, toward mutual understanding and mature social integration. International television, with its potential for the nearly instantaneous sharing of experiences across the horizons of the world, unfolds the most promising force for ultimate peace the world has ever known. Television can supply the needed basic elements for the development of the socially integrated world community.

While no engineer would subscribe to the conclusion that any of your proposed plans are feasible at this time, all thoughtful engineers will support you in your contention that a practical solution can be found only after there is full recognition of the nature and the boundaries of the problem. A serious exploration of the trans-Atlantic TV problem now should cut the eventual time of solution in half.

D. E. NOBLE
Vice Pres. in Charge
Communications and Electronics Division
Motorola, Inc.
4545 Augusta Blvd., Chicago

Latin-American and Asian Links Important, Too

I have read with interest your letter to The President of the United States relative to Trans-Atlantic TV. You are to be congratulated for your foresightedness in this matter, and you should receive the support of every progressive thinking person in the country.

The several methods suggested in your letter for trans-oceanic television are practical, but naturally they involve tremendous capital investment. Nevertheless, the achievement of Trans-Atlantic TV is of such importance to the public that active steps should be taken now to provide the facilities for an interchange of sight and sound between this country and other nations of the world. Perhaps, high in the order of priority is a television link between the United States and Europe, but, in my opinion, a link between the United States and Latin America and the United States and Asia likewise looms high in the order of priority.

T. A. M. CRAVEN
Craven, Lohnes and Culver
Consulting Radio Engineers
Munsey Building
Washington 4, D. C.

Will Stimulate Thought

I think your editorial "Let's Get Action on Trans-Atlantic TV" is a good one and should stimulate a lot of interesting thought that should result in a great deal of information.

LEWIS M. CLEMENT
Technical Advisor to General Manager
Crosley Division
Avco Manufacturing Corporation
Cincinnati, Ohio

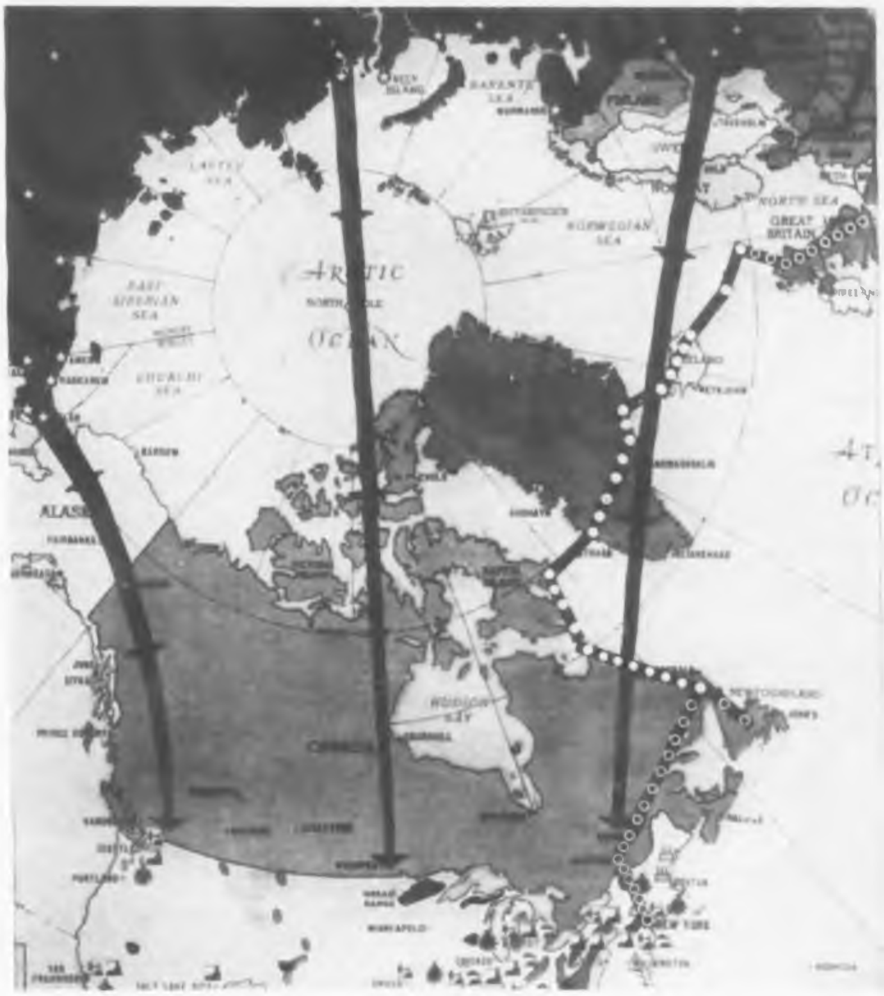
Technical Problems Not Insurmountable

Your letter to the President urging action on Trans-Atlantic TV is very timely.

The responsibility for leadership in the struggle for world peace has fallen upon our nation. How better can we portray to Europe the advantages enjoyed by a free people than through the medium of television. Conversely, and of no less importance would be the advantage to our people, to view by television, the great news events of foreign powers.

The technical problems are great but not insurmountable. You and your associates are to be congratulated for the initiative you have taken. I firmly believe your efforts will be rewarded by Government action.

F. A. D. ANDREA
President
Andrea Radio Corp.
Long Island City, N. Y.



Circumpolar map showing shortest bombing paths from Russia to our northern boundary. Also how proposed Trans-Atlantic TV relay would provide radar protection against eastern path

A Factor in World Peace

Your editorial on Trans-Atlantic TV certainly seems timely. The now numerous prospective methods for constructing a Trans-Atlantic circuit establish a presumption of early feasibility.

It is not clear to me whether such a circuit, if feasible, should be built and operated by public or private agencies. At the moment, my preference would be toward the latter, with some form of assistance to the private agency out of public funds to the extent needed to make the operation solvent.

It seems to me probable that a gradual increase in understanding among the peoples of the world is at least a major help and perhaps even a necessary condition to the bringing about of an honorable and durable world peace. Is there a better cause to work for?

A. V. LOUGHREN
Director of Research
Hazeltine Corporation
Little Neck, L. I., N. Y.

Enlist Private Enterprise In Project

Your editorial (Tele-Tech, August) on transatlantic TV deserves to needle technology into action, though one might hope it would ultimately be through private enterprise which is the best touchstone of intrinsic worth. In the present instance private underwriting would constitute a warranty that a proper balance had been struck between the value of spot news or live programming, where an electrical TV feeder is

(Continued on page 92)

WASHINGTON
News Letter

Latest Radio and Communications News Developments Summarized by TELE-TECH's Washington Bureau

TELECOMMUNICATIONS PLANNING COMMITTEE—The creation of a Telecommunications Planning Committee to formulate detailed plans for the most efficient use of the nation's communications systems in the event of war and also to study the need for and feasibility of new technological advances in the field of international communciations has been announced by Haraden Pratt, Telecommunications Advisor to the President. Mr. Pratt stated that five government agencies had accepted his invitation to form the new committee. The committee's work, he noted, will be similar in many respects to that of the Defense Communications Board, later the Board of War Communciations, during World War II.

PARTICIPATING AGENCIES—Department of State, represented by Director Paul Barringer of the Office of Transport and Communications Policy; Department of Defense, represented by Rear Adm. John R. Redman, the Communications-Electronics Director of the Joint Chiefs of Staff: Department of Commerce, represented by Rear Adm. Charles F. Horne (USN, ret.), Administrator of the Civil Aeronautics Administration; the FCC, represented by Commissioner E. M. Webster; and the Central Intelligence Agency. Only planning and coordinating functions have been assigned to the committee. Any operating or procurement activities resulting from recommendations by the committee will be performed by the agencies affected. An immediate major task of the Telecommunications Planning Committee, in its drafting of an overall program for the communciations requirements for the nation in the event of war, will be the coordination of the existing plans of the different government agencies. Other government agencies will be expected to participate in the committee's functioning. Non-government organizations in the communications field will be consulted as necessary.

FCC TELEVISION HEARINGS—With the commencement of hearings by its corps of examiners on Oct. 1, the FCC starts on its long course of building up the nation's television coverage to an eventual total of 2,000 or more video outlets, a goal so greatly desired by the American public. The Commission has been granting an average of more than five new station applications a week since mid-July or a total of more than 60 to date. In order to expedite the processing, the FCC has increased the staff under its Broadcast Bureau Chief Curtis B. Plummer and its License Division by approximately 25 accountants, engineers, attorneys and clerks. That the task of the Commission will be huge is a foregone conclusion and it will undoubtedly last for two years before the 2,000 stations are authorized and are on the air telecasting.

EDUCATIONAL TV—During September and October many state legislatures will be acting upon appropriations, it is anticipated, to launch state university and state and municipal non-commercial educational television station projects. This will mean a step-up in the filing for educational video stations. Nevertheless, the FCC had received relatively few of these applications up to TELE-TECH's press deadline. However, the FCC has been advised properly by television broadcasting organizations that it should grant the same "rules of the game" for non-commercial educational television station applicants as are required of the commercial television applications. This view was epitomized by the NARTB recently in stressing in the case of the educational TV application of Kansas State College of Agriculture and Applied Science that no license should be issued until the financial ability of the applicant is proved.

MOBILE RADIO IRE MEETING—More than two hundred radio engineers who are leaders in the mobile radio field are slated to attend the third annual meeting of the Institute of Radio Engineers' Professional Group on Vehicular Communciations to be held in Washington Dec. 3 to 5. Major subject of discussion and of technical reports will be on the most economical and efficient use of the frequency space assigned to the mobile communications services. In addition, the meeting will be featured in its deliberations on the subject of adjacent and split-channel operation of mobile radio equipment. It is anticipated that there may be demonstrations of the latest types of equipment in adjacent and split channel operation by leading manufacturers such as RCA, General Electric, Motorola, Federal Telephone and Radio and Raytheon. Frederick T. Bundelman, President of the Budelman Radio Corp., is chairman of the I.R.E. Group. and FCC Safety and Special Radio Services Bureau. Edwin L. White and Joseph E. Keller of the American Petroleum Institute are co-chairmen of the meeting's arrangement committee. Key representatives from the utility, petroleum, police and bus-taxicab mobile radio fields are expected to present surveys of the progress in their respective services.

National Press Building
Washington, D. C.

ROLAND C. DAVIES
Washington Editor

QUANTITY PRODUCTION OF LOW LOSS MICA COMPONENTS . . . exclusively a CINCH feature . . . and an other contributing factor in the choice of CINCH electronic components as **STANDARD**

MOLDED SOCKETS

(Above) CINCH Octal molded socket, 1-5/16" Mtg. Center, 1-1/2" M.C. available.
(Left) Loktal Molded Socket, 1-5/16" mtg. Center.

The miniature, Noval, Octal and Loktal Sockets are molded from high dielectric black bakelite and Mica . . . with component parts of the best materials available; sturdy steel mounting saddle and CINCH solder coated contacts for easy soldering. Dependable and durable under the most exacting requirements.

CINCH constantly demonstrates ability to hold tolerances on Mica moldings . . . to meet the most exacting requirements in small metal plastic assemblies for components of higher quality materials held to closer tolerances.

(Above left) Cinch Noval socket — saddle type Mica filled molded with .093 mtg. hole 1-1/8" mounting center. (Left) Molded Miniature, 7/8" mounting center.

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Cinch ELECTRONIC COMPONENTS

CINCH MANUFACTURING CORPORATION

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TELE-TECH's NEWSCAST

High-Purity Silicon Powder for Microwave Crystals

High purity silicon powders especially processed to meet the rigid chemical requirements for the manufacture of crystals for radar, video relay, and other microwave applications are now available from the Tungsten and Chemical Division of Sylvania Electric Products, Inc. of Towanda, Pa.

The new silicon powders have purities of 99.85% and 99.95% as compared to previous powers supplied with purities of 95.75%. A New process assures uniform chemical composition and physical properties from batch to batch, and should permit the production of crystals for use as microwave detectors and mixers in radar and video applications with a predictable range of electrical characteristics.

AT&T Expands Television Services

The long Lines Dept. of the American Telephone and Telegraph Co. has announced that a new northbound television channel from Miami, Fla. to Atlanta, Ga. will become available on Jan. 1, 1953. Designated as being for occasional service, this new channel will permit the origination of nationwide TV broadcasts from Miami.

Also scheduled for completion on Jan. 1 are two new northbound channels connecting with Dallas, Tex. and New Orleans, La. These facilities, available for occasional service, would permit interconnection of Dallas with the transcontinental microwave relay system at Omaha, Neb. and connect New Orleans with the national network at Jackson, Miss.

By early fall a new 11 station radio relay system between New York and Washington is scheduled to be put into operation. Relay towers for this system are located in Atlantic Township, New Egypt, New Albany and Swedesboro, N.J., at North East, Carney, Gambrills, Baltimore, Md., New York City, N.Y., Philadelphia, Pa., and Washington, D.C.

NARTB History to be Recorded

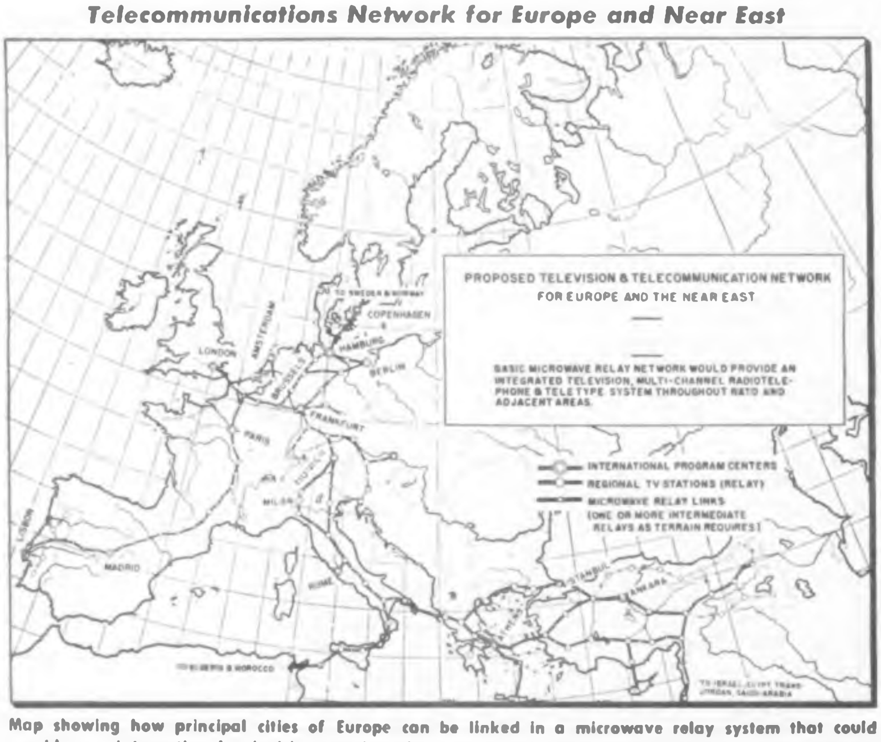
Harold E. Fellows, president of the National Association of Radio and Television Broadcasters has announced that a history of the NARTB will be written by David R. Mackey, assistant professor of speech, Pennsylvania State College. Professor Mackey estimates that his comprehensive examination of the 30-year history of the broadcasting industry's trade association will require a minimum of two years for completion. The finished history will be submitted to Northwestern Univ., Evanston, Ill., as Professor Mackey has chosen this subject for his Ph. D. thesis.

Sarnoff Gold Medal to SMPTE's A. Jensen

Peter Mole, president of the Society of Motion Picture and Television Engineers, has announced that the David Sarnoff Gold Medal Award will be presented this year to A. G. Jensen, director of television research, of Bell Telephone Laboratories, Murray Hill, N. J.

The official presentation to Mr. Jensen will be made during SMPTE's 72nd semi-annual convention at the Statler Hotel, Washington, D. C.

Telecommunications Network for Europe and Near East



Map showing how principal cities of Europe can be linked in a microwave relay system that could provide an international television service along with both civilian and military communications facilities. Stations would be placed on mountain peaks and designed to operate unattended. Helicopters to be used to provide any necessary services. This system can also be integrated with a Trans-Atlantic TV System (see Aug. issue editorial and page 66, this issue). Full details in Tele-Tech next month.

Coming Events

October 6-10—SMPTE, 72nd Convention, Hotel Statler, Washington, D. C.

October 13-17—AIEE, Fall General Meeting, New Orleans, La.

October 13-15—RTCM, Fall Assembly Meeting, Hotel Roosevelt, Washington, D. C.

October 20-22—1952 RTMA-IRE Fall Meeting, Syracuse, N. Y.

October 29-November 1—Audio Fair, Sponsored by AES, Hotel New Yorker, New York, N. Y.

November 5-7—IMS, 16th Annual Time and Motion Study Clinic, Sheraton Hotel, Chicago, Ill.

November 7—IRE, Microwave Professional Group Symposium on Microwave Circuits, Auditorium, Western Union Telegraph Co., 60 Hudson St., New York, N. Y.

November 21-22—IRE, Kansas City Section, 4th Annual Regional Papers Technical Conference, President Hotel, Kansas City, Mo.

December 3-5—Third annual IRE Professional group on Vehicular Communications, Washington, D. C.

December 10-12—IRE-AIEE Computers Conference, Park Sheraton Hotel, New York, N. Y.

January 14-16—IRE-AIEE Meeting on High Frequency Measurements, Washington, D. C.

March 23-26—IRE National Convention, Grand Central Palace & Waldorf-Astoria Hotel, New York, N. Y.

May 18-21—Electronic Parts Show, Conrad Hilton Hotel, Chicago, Ill.

AES: Audio Engineering Society
AIEE: American Institute of Electrical Engineers
IRE: Institute of Radio Engineers
IMS: Industrial Management Society
RTCM: Radio Technical Commission for Marine Services
RTMA: Radio-Television Mfrs. Assn.
SMPTE: Soc. of Motion Picture and TV Engineers

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NEW EQUIPMENT for Designers and Engineers

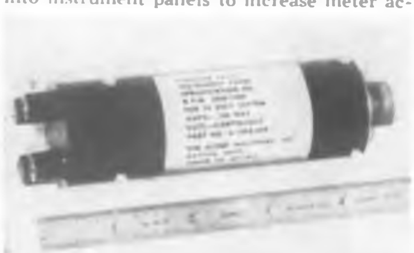
Power Transformer

A new toroidal power transformer eliminates hum-pickup in audio amplifiers. Known as type MT-1001, it replaces ordi-

nary power transformers in high gain amplifiers where an absolute minimum of hum-pickup through magnetic field radiation is desired. The transformer is precision wound on a ring core without air-gaps and radiates less than 01 Gauss at 5 in. from its surface. By parallel or series connection and doubler or tripler circuits the following dc voltages for plate supply may be obtained: 350, 700, 1,200 and 1,800. It has 2 separate heater windings which are rated 6.3 v. and 1.5 amps. —**Millivac Instrument Corp., Engineering Dept., P.O. Box 997, Schenectady, N.Y.**—TELE-TECH

Vibrator

A new panel vibrator will introduce a vibration of known frequency and amplitude into instrument panels to increase meter ac-



curacy and prevent sticking. It is an electrically driven device operating continuously. Motor power for the vibrator is furnished by a fractional horse power motor operating at any standard dc voltage. The motor is a two-pole, two-brush design. An unbalanced weight is mounted on the end of the armature shaft. Weight provides the vibration action of the assembly. Shaking forces, at 2500 rpm, can be provided from 0.85 lb. to 3.4 lbs. by varying the weight. The frequency 2000-3000 cpm.—**Globe Industries, Inc., 125 Sunrise Pl., Dayton 7, Ohio.**—TELE-TECH

Capacitor Network

Type BTN capacitive network is a multisection, metal encased, hermetically-sealed paper dielectric unit. Its multiple sections can be internally connected to provide a selection of either capacitive Pi, Y, or Delta

networks and can be provided with mineral oil, pentachlordiphenyl, or electrical grade waxes as impregnants. Type BTN is said to be useful in airborne equipment power frequency circuitry where the compact single unit construction offers space and weight saving advantages over three individual types. These networks are supplied in heavily tin coated ferrous or non-ferrous cases of the "bathtub" type with metallized Pyrex glass solder-seal terminals.—**Sangamo Electric Co., Capacitor Div., Marion, Ill.**—TELE-TECH

Decade-Inductor Units

The new 700 series decade-inductor units are useful in design and experimental work on audio filters, equalizers and tuned circuits

at frequencies between 150 to 20,000 cps. Four units are available in ranges from 10 x 0.001 henry to 10 x 1.0 henry. When all four units are connecting in series, 11,110 steps from .001 henry to 11.11 henries are obtained. Four type EM-1 toroid coils are used as elements in each unit. The 10 steps are obtained by series switching. "Q" factor remains essentially constant over all ranges. The decade-units are said to have excellent stability in respect to current and temperature changes and reasonable amounts of dc may be run through the units with small effect on inductance.—**Hycor Co., Inc., 11423 Vanowen St., North Hollywood, Calif.**—TELE-TECH

Miniaturized DC Relay

A new, miniaturized hermetically-sealed relay designated the RCA-203W1, is of the 6-pole, double-throw type operating on 26.5

v. The miniaturized-type design features sturdy and compact construction, palladium contacts, moisture-free-gas filling, and long operating life. It will meet the requirements of the Air Force (Specification MIL-R-5757) and is engineered to provide longevity of service under extremes of temperature, humidity, shock, vibration, and voltage variations as stipulated in this military specification. The 203W1 weighs only 3 oz. and can be operated in any position. Its 6-pole, double-throw construction features palladium contacts rated to handle 2 amps. with a resistive load at 26.5 v. dc and one ampere with an inductive load at the same voltage. Contacts are arranged in a break-before-make sequence.—**Tube Dept., Radio Corporation of America, Harrison, New Jersey**—TELE-TECH

Composite Picture Generator

Model 305-BR monochrome composite picture generator produces high-definition television picture signals from still tran paren-

cies, film positives, glass slides, or block opaques such as lettering mounted on a transparent background. This unit is useful in studio work for carrying test patterns or slides, and can also present art work, cartoons, animated displays, announcements, etc. It will provide special effects such as the pointer for a map, vertical, diagonal and horizontal wipes, lap dissolves and vignettes of any shape. In making the special effects, the unit may be used to blank or pedestal any portion of a standard television picture, allowing normal full contrast range for the inserted picture. Standard RTMA Composite Video Signals are available: black level positive and black level negative. Resolution is greater than 600 lines at center and 500 lines at corners of standard RTMA test pattern. Gamma Correction may be removed and is variable over a wide range.—**Telechrome, Inc., 88 Merrick Rd., Amityville, N.Y.**—TELE-TECH

Video-Audio Switching System

Type CRS-2 video and audio preset switching system accommodates six inputs, and one monitor and two line outputs. Auto-

matic switching of desired combination of feeds arranged on preset bank is accomplished by push buttons. Indicating lights keep tally of preset and in-use circuits. Full remote control of all switching operations is easily initiated and registered by tally lights. Rotary selector permits complete previewing of any of six inputs. Muting relays for intercom and talkback in feeding studio are actuated by outgoing signal. Design allows custom installation in console, rack, and desk turret mountings to suit individual station requirements.—**General Communications, Fort Atkinson, Wis.**—TELE-TECH

This new Vacuum Gauge

covers a range of 5,000,000:1 on a single meter from a single pickup

It's the DPi Philips Gauge, Type PHG-09, a remarkable new instrument developed by DPi high vacuum research. Here are the basic facts about it:

- A single meter covers the entire range from 0.50 mm to 10^{-7}mm Hg.
- A single all-metal pickup tube handles this range. It works on the glow discharge principle. Permanent magnets provide a field which lengthens the electron paths into tight spirals that give high ionization per electron, with a cascade effect.
- Having no filament to burn out, the tube can be operated at full atmosphere without damage, and the circuit is insensitive to fluctuations in the line voltage.
- With the magnets external to the ionization chamber, there is no problem of outgassing them or removing stray iron particles.
- Self cleaning, the tube at the higher pressures in the low sensitivity range automatically rids itself of deposited film because polarity is reversed.

This new Philips gauge is now being used in DPi exhaust machinery where close control of pressure is required. For information on this or any equipment for the creation and measurement of high vacuum in the electronics industry, write to ***Distillation Products Industries,*** Vacuum Equipment Department, 629 Ridge Road West, Rochester 3, N. Y. (Division of Eastman Kodak Company).

high vacuum research and engineering

DPi

Also . . . vitamins A and E . . . distilled monoglycerides . . . more than 3500 Eastman Organic Chemicals for science and industry

Plug-In Amplifiers

A new line of miniature plug-in preamplifiers, line or monitor amplifiers, and power supplies designed primarily for use with the

Altec 250A speech input console are equally adaptable for custom built consoles or for any other speech input application where performance, size and quick replacement are a factor. The preamplifier dimensions are: 1⅝ x 4¼ x 9 in., while dimensions of the line amplifiers and power supplies are 2⅝ x 4¼ x 9 in. Frequency response of all amplifiers is ±1 db from 20-20,000 CPS and noise level is kept very low through the use of especially designed miniature transformers with 90 db of shielding. Both the amplifiers and power supplies are equipped with a handle and plug-in connectors, and are designed to fit into a cover tray which can be permanently mounted in a rack or cabinet. On one end of this tray is the receptacle to which all wiring connections are made. The plug-in unit slides easily into the tray and automatically centers its plug with the receptacle. When necessary the unit may be quickly removed for bench servicing or for immediate replacement with a spare unit.—**Distributed by Graybar Electric Co., Inc., Altec Lansing Corp., 9356 Santa Monica Blvd., Beverly Hills, Calif.**—TELE-TECH

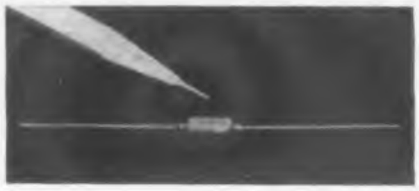
Oscillator

A new low frequency oscillator, designed as a source of signal power in the range of .01 to 100 CPS, features the use of passive elements (resistors and capacitors) for frequency determination. The circuit has been treated as a dc amplifier, and both plate and filament supplies have been carefully regulated. The output circuit is directly cou-

pled to the load and will produce 20 v. or 20 ma into any load impedance. This instrument is a true sine wave generator, and the wave shape contains only low order harmonic distortion. Two separate means for amplitude control have been provided. An oven-controlled thermistor is used as a quasi-linear element where extremely low distortion is required (in the order of 0.1 of 1%). A varistor is also provided in a unique circuit which allows it to control the amplitude by creating 1% or less distortion (primarily third harmonic). Since the non-linear amplitude controlling element does not involve the quantity "Time," there is no amplitude bounce associated with its controlling action, and the initial switching transient which occurs when changing ranges has been reduced to about 10% by keeping the range capacitor precharged to their operating potentials. The unit is housed in a welded aluminum cabinet, 18 x 18 x 12 in., and weighs approximately 65 lbs.—**Southwestern Industrial Electronics Co., 2831 Post Oak Road, P. O. Box 13058, Houston 19, Texas.**—TELE-TECH

R-F Chokes

A regular production line of tiny r-f chokes are believed to be the smallest chokes on the market as standard catalog



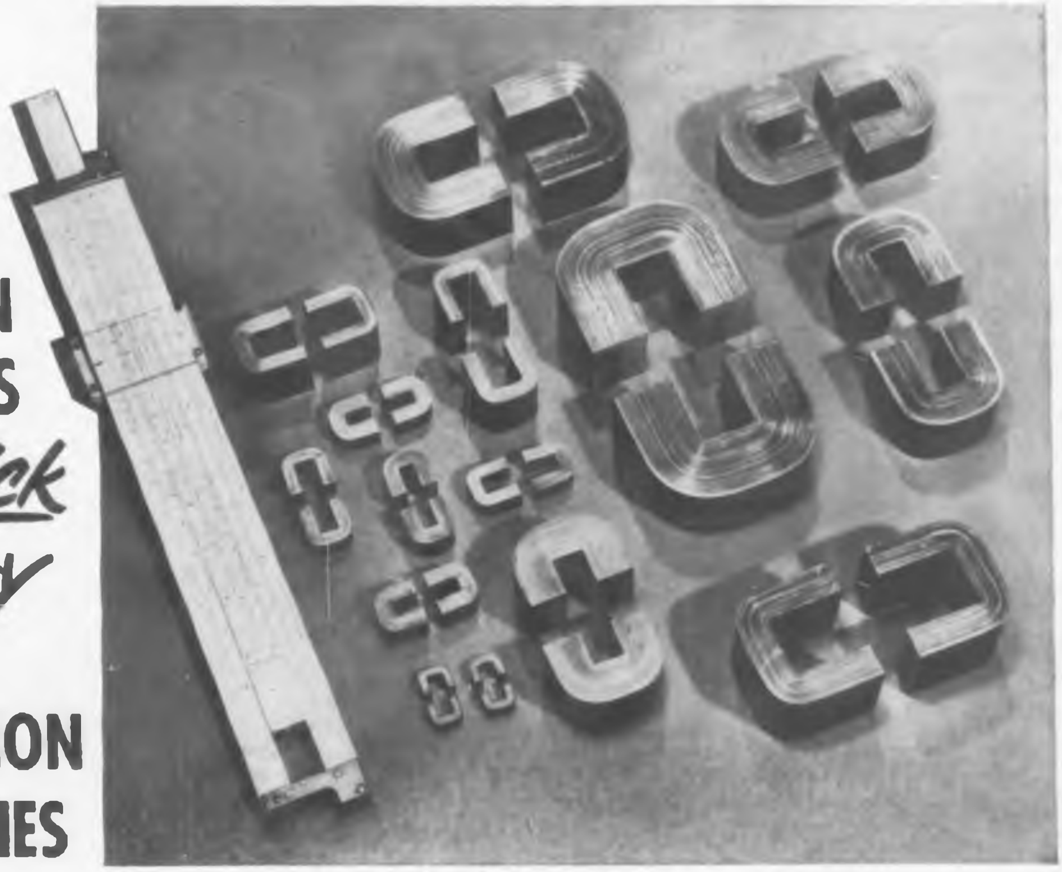
items. They range in inductance from 0.25 to 100 µh and are plainly marked and insulated for 500 v.—**Condor Radio Mfg. Co., 116 N. Montezuma St., Prescott, Ariz.**—TELE-TECH

Laboratory Amplifier

Model SR88 amplifier pre-amplifier combination can be used in conjunction with any high quality tuner not providing a

properly compensated phono pre-amplifier. Distortion at 15 watts is 400 CPS 0.32% harmonic. It does not exceed 0.5% harmonic distortion at any frequency, from 30 cycles to 15,000 CPS. Intermodulation distortion (40 & 7000 CPS, SMPE Standards) is 2.5%. Even at 25 watts, distortion is limited to 1.0% harmonic. Frequency Response is ± .2 db, 20 to 20K CPS. The hum-free magnetic phono pre-amplifier has adequate gain for low level reluctance cartridges. Uses feedback circuit for lowest distortion and fully compensated bass response. Input and output jacks, plus cables, are provided for easy connection to switching facilities. Inverse feedback of 26 db affords an extremely high damping factor. Voltage-rise of less than 0.3 db between full-load and no-load provides maximum control over speaker and insures low distortion performance regardless of variations in speaker impedance.—**The Sargent-Rayment Co., 212 9th St., Oakland 7, Calif.**—TELE-TECH

SILECTRON
"C" CORES
for quick delivery
IN
PRODUCTION
QUANTITIES



... wound from strip as thin as 0.00025"

Quality-Tested and Proved

★ Arnold "C" Cores are made to highly exacting standards of quality and uniformity. Physical dimensions are held to close tolerances, and each core is tested as follows:

★ 29-gauge Silectron cut cores are tested for watt loss and excitation volt-amperes at 60 cycles, at a peak flux density of 15 kg.

★ 4-mil cores are tested for watt loss and excitation volt-amperes at 400 cycles, at a peak flux density of 15 kg.

★ 2-mil cores are tested for pulse permeability at 2 microseconds, 400 pulses per second, at a peak flux density of 10 kg.

★ 1-mil cores are tested for pulse permeability at 0.25 microseconds, 1000 pulses per second, at a peak flux density of 2500 gauss.

★ ½ and ¼-mil core tests by special arrangement with the customer.

Now available—"C" Cores made from Silectron (oriented silicon steel) thin-gauge strip to the highest standards of quality.

Arnold is now producing these cores in a full range of sizes wound from ¼, ½, 1, 2 and 4-mil strip, also 29-gauge strip, with the entire output scheduled for end use by the U. S. Government. The oriented silicon steel strip from which they are wound is made to a tolerance of plus nothing and minus mill tolerance, to assure designers and users of the lowest core losses and the highest quality in the respective gauges. Butt joints are accurately made to a high standard of precision, and careful processing of these joints eliminates short-circuiting of the laminations.

Cores with "RIBBED CONSTRUCTION"* can be supplied where desirable.

Ultra thin-gauge oriented silicon steel strip for Arnold "C" Cores is rolled in our own plant on our new micro-gauge 20-high Sendzimir cold-rolling mill. For the cores in current production, standard tests are conducted as noted in the box at left—and special electrical tests may be made to meet specific operating conditions.

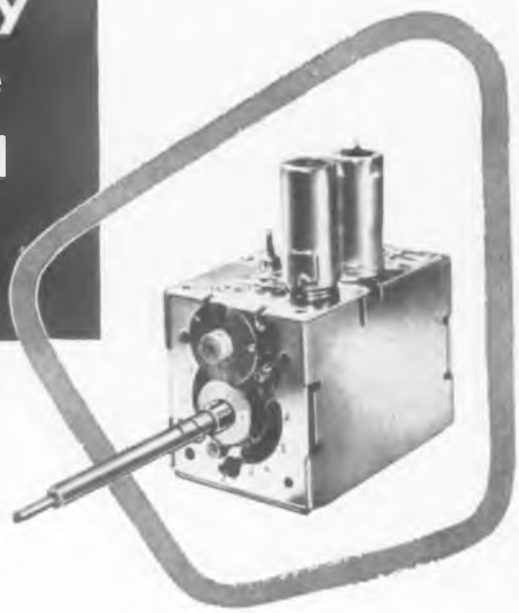
● **We invite your inquiries.**

*Manufactured under license arrangements with Westinghouse Electric Corp.

WAD 4211

THE ARNOLD ENGINEERING COMPANY
SUBSIDIARY OF ALLEGHENY LUDLUM STEEL CORPORATION
General Office & Plant: Marengo, Illinois

Everybody likes the TARZIAN TUNER!



ENGINEERS like it because they appreciate the fine, scientifically-engineered qualities and features found in no other commercial tuner unit. And, they are especially enthusiastic about the Tarzian approach to UHF.

PURCHASING AGENTS like it because it's competitively priced and offers more value per dollar than any other commercial tuner.

THE CONSUMER or set buyer is happy with the excellent performance of his receiver, although he doesn't have the slightest idea of the importance of the TARZIAN TUNER in the satisfactory operation of his set.

SERVICEMEN like it because of the simplicity in servicing and aligning.

SARKES TARZIAN, INC.

Tuner Division, Bloomington, Indiana

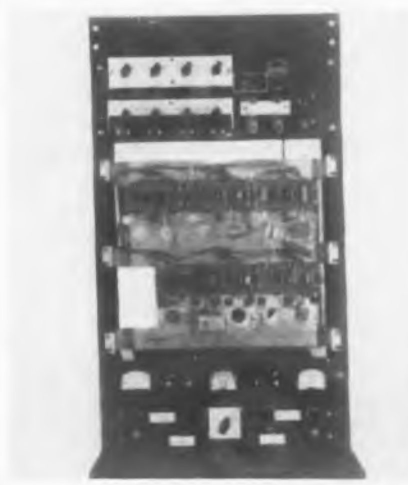
High Voltage Tester

The Hi-Tronic tester is an electronic-controlled high voltage tester operating at very low current, eliminating the possibility of

dangerous shock to the operator. It will operate on circuit resistances up to 1 megohm per 100 v. (5 megohms at 500 v. or 10 megohms at 1000 v.) The need for watching an indicator light is obviated by an alarm buzzer which is incorporated in the unit, so that the operator can devote his full attention to the apparatus under test. This tester can be supplied with special circuit and relay connections to operate any device or equipment normally used in conjection with high voltage tests.—**Bliss Electronic Corp., Box 123, Sussex, N.J.**—TELE-TECH

Laboratory Assemblies

System for rapid assembly and testing of experimental circuits features metered power supply and test panel with decade capacitor.



decade resistor, and measuring bridge. Series of panels, mounting channels, bench supports, and layout sheets provide versatile RAK-LAB arrangement for mounting wide variety of circuits. Model 401 power supply covers 0 to 400 v. at 150 ma, 0 to 12.6 v. at 5 amps, 0 to 6.3 v. at 10 amps, and sells for $290. Model 402 test panel, including decades and bridge for measuring inductance, resistance and capacitance sells for $290.—**Davies Labs., Inc., 4705 Queensbury Rd., Riverdale, Md.**—TELE-TECH

Reversible Motor

A reversible 2-pole, 4-coil motor for both remote control TV tuner and rotating antenna applications, has been designated the Model O. It can be furnished either as split-phase capacitor type or split-phase resistance type, depending upon application requirements. It is designed for 24, 12, or 6 v., ac, 60 cps, and may be used either horizontally or vertically without affecting performance characteristics. One motor type having 3 leads is designed for use with single-pole, double-throw switch. Adaptation, with 4 leads for use with double-pole, double-throw switch, is available where increased output is desired.—**The General Industries Corp., Elyria, Ohio**—TELE-TECH

1922 Close Tolerance Mica Capacitors

1929 Halowax Capacitors

1930 Dry Electrolytic Capacitors

1940 High and Low Temperature Electrolytic Capacitors

1947 Aerolene Impregnated Capacitors

1951 High Temperature Metallized-Paper Capacitors

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in 1952 AEROFILM* Capacitors

The development of Mylar** polyester film by Du Pont chemists and its adaptation as a capacitor dielectric by Aerovox engineers, presents challenging potentialities in the field of electronic capacitors.

Known as Aerofilm Capacitors, these latest components permit higher operating temperatures without corresponding increase in size, as well as unusually high insulation resistance. Both gains mean much to the designers of tomorrow's fantastic weapons and again to peaceful electronic applications. Thus in 1952 Aerovox auspiciously embarks upon its fourth decade of capacitor craftsmanship.

*Aerovox Trade Mark **Du Pont Trade Mark for polyester film

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Browning OSCILLOSYNCHROSCOPES ON-5A ON-5X

SYNCHROSCOPE P4-EX

Models ON-5A and ON-5X are designed as basic, highly flexible laboratory instruments for general pulse work. Their specifications include:

- High-gain vertical amplifiers.
- Triggered sweeps, from an external trigger or from the input to the vertical amplifier.
- Recurrent sweeps, at a repetition rate of 10 to 100,000 per second.
- Vertical input delay of 0.45 microsecond (ON-5X).

Model P4-EX is designed for applications requiring a triggered sweep, and where the signal levels met do not demand extremely high-gain amplification. Its many outstanding features include:

- Internal trigger, at a repetition rate of 50 to 5000 per second, easily synchronized with an external trigger if desired.
- Output trigger, with the same range of repetition rates, which can be continuously phased to lead or lag the sweep start by a maximum of 500 microseconds.

Detailed specifications and performance data available promptly on your request.

These new instruments represent a high level of precision design and versatility of application at remarkably low cost. Major features that are common to all three instruments include:

- Type 5UP cathode-ray tube, operating at an accelerating potential of 2600 volts. P1, P7 and P11 screens are available.
- Sweep writing rate continuously variable from 1.0 to 25,000 microseconds per inch.
- Sweep calibration in microseconds per horizontal scale division, accurate to plus or minus 10%.
- Vertical amplifier flat within 3 db from 5 cycles to 5 megacycles.
- Vertical calibration voltages, at accuracy of plus or minus 5% for Model P4-EX, and plus or minus 10% for Models ON-5A and ON-5X.
- Vertical amplifier input step attenuator.
- CRT cathode connection externally available, for application of blanking or marker pulses.

NET PRICES, F.O.B. Winchester, Massachusetts:
P4-EX . . . $465.00 ON-5A . . . $485.00 ON-5X . . . $535.00

Write today for **FREE BULLETINS** giving detailed specifications and performance data.

BROWNING Laboratories, Inc. Winchester, Mass.
ENGINEERED FOR ENGINEERS

Standing Wave Detector

Featuring accuracy and simplicity, Type-1022 standing wave detector will make precision low level impedance measurements in the millimeter region when used with a

suitable source and amplifier. VSWR's as low as 1.01 can be read accurately in the region from 34 to 36 kilomegacycles/sec. The unit consists of a slotted section of RC-96/U waveguide milled from a solid piece of brass and silver plated. A movable carriage is provided carrying a spring-loaded adjustable coupling probe, a silicon diode detector socket, and coaxial output fitting which will mate with a UG-88/U or equivalent BNC cable connector. This carriage rests on a semicylindrical polished bearing surface and is positioned by a micrometer drive. A total longitudinal probe displacement of 0.750 in. is available. The probe position can be read accurately to 0.001 in. Total insertion length of the unit is 3.25 in.—**Microwave Associates, Inc., 22 Cummington St., Boston 15, Mass.**—TELE-TECH

Radar Range Calibrator

Type 2010 range calibrator, designed for production testing and calibrating of radar receivers, embodies several basic circuit features which obsolete the TS-102/AP range calibrator for applications requiring accurate pulse repetition rates and absolute freedom from marker jitter. The type 2010 offers: crystal-controlled pulse rates of 200 to 2000 pps. derived from a 327.80 KC marker crystal by the use of a binary divider system; "Master-Slave" operation permitting the use of a number of calibrators for multi-position test systems; narrow and stable 500 yard marker pulses; and a completely regulated power for operation from 105-125 v., 100 W 50-60 cps.—**Tel Instrument Co., 50 Paterson Ave., East Rutherford, N.J.**—TELE-TECH

NEC Exhibits • • • •

Turn to pages 64, 65, 80 and 82 for more reviews of products being exhibited at the National Electronics Conference.

Variable Transformer (98-101)

Type 10 powerstat variable transformer for 50, 100 and 150 watt ac control applications is rated at 120 v., 60 cycles, single-

phase input. Output is 0-120/132 v., 1.25 amps. Designed for single-hole mounting, compactly constructed unit measures 3 in OD, and 2 1/16 in. under-chassis depth. Transformer weight is 1 lb., 13 oz. List price is $8.50. **Superior Electric Co., Bristol, Conn.** —TELE-TECH

AMAZING *NEW* IMPREGNANT

makes good capacitors better by permitting higher operating voltages

E-therm impregnated capacitors are now available in production quantities. E-therm is a unique new impregnating material developed and compounded by Sangamo. E-therm impregnated capacitors far exceed the requirements of JAN Specifications. E-therm possesses exceptionally high thermal stability and superior electrical characteristics. E-therm impregnated capacitors mean—higher operating temperatures—lower power factor—higher resistance—longer life.

E-therm

DEVELOPED BY SANGAMO

Operating temperature 125°C

E-therm is another example of advanced Sangamo engineering. Continued research and development of new products enables Sangamo to meet the existing and future needs of the electronic industry. *For additional information about E-therm, write for Engineering Bulletin No. 104A.*

Those who know The SANGAMO Tribe PAPER-MICA-SILVER-ELECTROLYTIC CAPACITORS *...choose Sangamo*

SANGAMO ELECTRIC COMPANY

MARION, ILLINOIS

Specialists IN RADIO, T-V, AND ELECTRONIC COMPONENTS

A—R. F. Filter unit (special military application)
B—I. F. Transformer
C—Horizontal width coil
D—Video peaking coil
E—Flyback transformer conventional type
F—Flyback Transformer high efficiency auto-transformer
G—Patented high voltage corona free tube socket assembly
H—Patented feed-thru interlock assembly
I—Exclusive design duo decal sector assembly
J—Duo-decal assembly for electro-static tube
K—Special wiring harness (ARC-27)

RAYPAR also manufactures all sorts of I. F. and R. F. windings, such as antenna coils, oscillator coils, R. F. chokes, flyback transformers, width coils, linearity coils, video peaking coils, filter assemblies, and special purpose R. F. coils of any type or construction.

Our special products division handles all government contracts such as chassis assemblies, cable harnesses, terminal boards, and special purpose test equipment.

SERVING AMERICA'S LEADING RADIO & T-V MANUFACTURERS

RAYPAR Incorporated

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Balun (3)

Type 874-UB balun makes it possible to measure balanced circuits in the range 50 to 1000 MC using grounded measuring systems. Balanced to unbalanced transformation is obtained by using a semi-artificial half-wave coaxial line made of two sections of

50-ohm coax and two shunt tuning elements. Well adapted to measuring 300-ohm balanced lines, the instrument is tuned by various lengths of air line. Also presented are the Type 1555-A sound-survey meter covering 40 to 136 db above 0.0002 μbar reference level, costing $125; Type 1551-A sound-level meter covering 24 to 140 db above 0.0002 μbar, costing $360; and Type 874-LK constant-impedance adjustable line with 50 ohms impedance, and selling for $36. **General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass.**—TELE-TECH

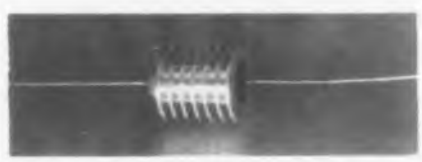
High Frequency VTVM

MV-22A vacuum tube voltmeter for ac is a further development of the MV-12A meter recently announced. The older instrument has a frequency range of 20 cycles to 250

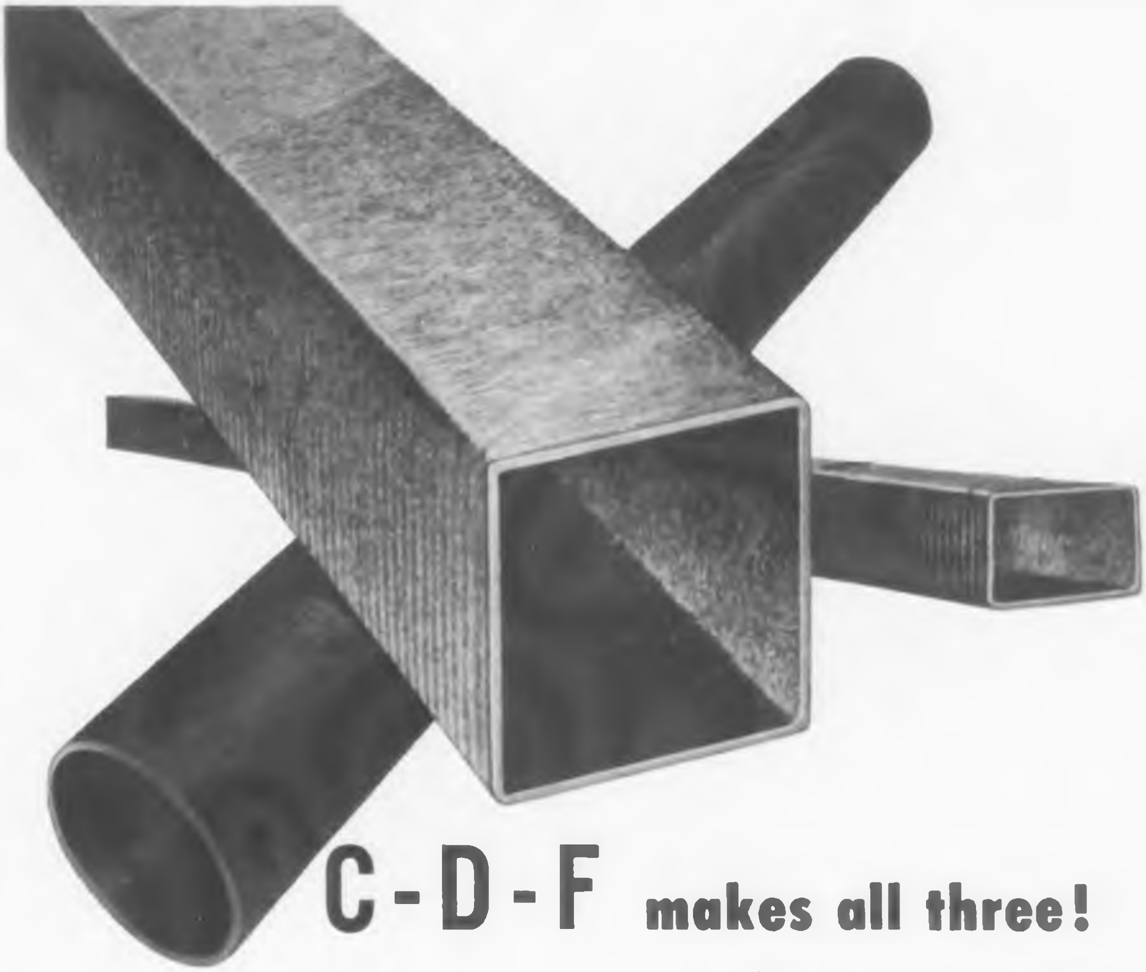
KC. The new meter has been extended to 6 MC. The instrument has a six-state amplifier with a novel ac regulated power supply. It measures voltages between 70 and 1000 v. **—Millivac Instrument Corp., 444 Second St., Schenectady 6, N. Y.**—TELE-TECH

Power Rectifier

Germanium junction-type power rectifier has maximum rms rating of 1.2 amps, 130 v. input. Forward resistance is 3.5 ohms, while high back resistance is 50,000 ohms. Frequency range extends up to 30 KC, with



operating life of 70,000 to 100,000 hours. Small size of $\frac{5}{8}$ x $\frac{5}{8}$ in. makes unit desirable for TV and similar applications. Also available are photo tubes for film sound pick-up and electric eye applications. Lead sulphide cell has peak spectra response at 1.5 microns, cuts off at 3.4 microns, has time constant of 125 μsec. Cadmium sulphide cell has peak spectral response at 5300 Å, is sensitive to X-rays, and has time constant in the order of milliseconds.—**Lectro Max, Inc., 15 S. First St., Geneva, Ill.**—TELE-TECH



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Designers, engineers, production men everywhere are changing their thinking (and specifications) over to economical C-D-F spiral tubing. Whether it's round, square, or rectangular, C-D-F tubing is stiff, sturdy, crush resistant. It has good tensile strength, along with good dimensional stability under varying atmospheric conditions.

Above all, it is low in cost. C-D-F experts in insulation, recommend spiral tubing for coils and structural spacers. For transformers, switches, selenium rectifiers.

The round tubing ranges from 1/8" to 6", with wall thicknesses from .0075" to 1/8". The minimum ID of the square and rectangular tubing is 3/8", with 2 1/8" the maximum ID. 1/16" is the maximum wall thickness. All tubing can be supplied in lengths from 2' to 4'. From our own fabricating experience, we know you will find this sturdy material easy to drill, tap, rivet, flute or thread.

Think it over... then talk to the man from C-D-F, a skilled plastics engineer. C-D-F has sales offices in principal cities with modern test laboratories at all plants. C-D-F spiral tubing. The man from C-D-F. *Both* are good to know!

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C-D-F puts notches in so that cores can be inserted and accurately adjusted. Hard to crush, this tube withstands prolonged heat of 190 F., 240 F. intermittently. Write for samples and complete specifications. For availability, economy, adaptability . . . buy your spiral tubing from C-D-F.

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To this is added the plus value of:

1. Steward's private research and development,
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3. Interestingly low production costs of these parts, and
4. Prompt delivery.

And in addition to all this, you are invited to consult Steward engineers, without obligation, for scientific answers to your specific problems. Send me your specifications.

Ask for general characteristic data on all "Lavite" Technical Ceramics — ("Lavite" Steatite, "Lavite" Titanates, "Lavite" Ferrites, and others).

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Digital-to-Analog Converter (42-43)

Model 417 digital-to-analog converter transforms information from punched cards or tape recorder to analog form so that a

representative point plot can be made on a dc plotting board. System consists of a basic timer, two temporary storage units, X and Y scale factor circuits, X and Y parallax circuits, X and Y digital-to-dc converters, two dc amplifiers, control panel, and power supply. For points spaced ¼ in. or less, plotting speed is 50 points per minute. Converter accuracy is 0.02% of full scale. Accessories available are a typewriter binary converter and manual keyboard.—**Electronic Assoc., Inc., Long Branch, N. J.**—TELE-TECH

Frequency Analyzer (88)

Model 7T-4 **Stroboconn** measures all types of repetitive frequencies, constant or variable. Unit presents a continuous, visual pat-

tern for the duration of the signal. Precise analysis can be made to an accuracy of 0.05%. Minimum input is 1.5 mv. Signal is amplified to flash a neon tube which lights 12 rotating scanning discs. When one of the seven concentric patterns on a disc "stands still," the frequency is read directly in CPS. When more than one frequency is involved, other sections of the discs will appear stationary. The 6T-4's range covers 32.703 to 4.186 CPS. External frequency divider extends frequency range. Stroboconn checks and measures rotational speeds and natural frequencies, calibrates precision oscillators and tachometers, and compares ratios between frequencies without regard for the actual frequencies involved. —**C. G. Conn, Ltd., Elkhart, Ind.**—TELE-TECH


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MANUFACTURERS OF R. F. COILS AND ELECTRONIC EQUIPMENT

Cues for Broadcasters

(*Continued from page* 55)

purposes. This is especially true when recording is done from the transmitter, with even remotes handled in the some way. To eliminate this trouble, and also to avoid bothering studio personnel who might be busy at the time when the circuit was needed, a dialing system was installed, enabling the transmitter operator to dial certain combinations of studio equipment.

The control voltage originates at the transmitter, and is fed on a simplex of the spare studio-transmitter line to the dial selector at the studio. It is a simple matter to pick up, say, the network line, bridge it into a booster amplifier, and feed it to the transmitter for recording, or monitoring. Or there might be a special audition recording—then the booster amplifier could be bridged across the audition circuit on the console. In other cases it was used to pick up a certain remote line.

Makeshift Camera Crane

DURING the recent National Conventions in Chicago, NBC used an electric industrial truck designed especially for the occasion by the Automatic Transportation Co. of Chicago, to obtain high angle shots above the heads of the crowds. By allowing plenty of slack in the cables to the camera it was possible to provide limited horizontal movement as well as elevation to a height of 15 ft. above the ground. The Skylift's capacity of 6000 lbs. was not unduly strained by the weight of the cameraman, camera, and tripod!

NBC uses industrial truck as camera crane

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Developed by Sylvania scientists especially for the U. S. Armed Services, these premium tubes are designed for a life expectancy (80% minimum, average life) of 5000 hours, under test conditions, in an ambient temperature of 30°C.

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THE GENERAL INDUSTRIES CO.

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Direct Frequency

(*Continued from page* 53)

Vibrotron, a vibrating-string device whose output is a FM acoustic signal. Consideration of suitable meters and indicators to utilize this signal has led to the following comparison of meters for AM and FM signals. It will be seen that PM can use some of the same meters useful for FM signals. Insofar as this is true, this article is pertinent to pulse systems. There are, however, very few pulse transducers in general use. Fig. 3 shows typical characteristics for a frequency and an amplitude transducer.

Standards

Since a measurement system is no better than the standards used for instrument calibration, it is worthwhile to look briefly at primary and secondary standards for amplitude and frequency measurements.

The absolute standard for voltage-amplitude measurements is the saturated or normal Weston cell. Normal voltage of these cells is subject to variations so that the mean of a group of cells is used as the standard. The absolute accuracy is on the order of 1 part in 10^5, although secondary standards are claimed to be standardized with a precision of 1 part in 10^6. The accuracy of primary standards is of less interest for voltage standards than for frequency standards since it is not possible to transmit standard voltage levels over wires or radio circuits. In commercial standardizing laboratories, economic and technical difficulties reduce accuracy to the order of 1 part in 10^3, for voltage measurements.

Quartz Crystal Resonator

In contrast to standards of amplitude, there are many different methods by which accurate frequency standards can be established. The most accurate presently used are the quartz crystal resonator and atomic or molecular resonators. Although there is some discussion as to the absolute accuracy of primary standards, it is reasonable to take this figure as about 1 part in 10^8 or higher. Since standard frequencies can be transmitted from point to point, secondary frequency standards can be calibrated with relative ease and accuracy. Means are available for comparing two frequencies within 1 part in 10^{10}. It is possible to buy, at relatively high cost, a secondary frequency standard accurate to 1 part in 10^8 over periods of several months.

(*Continued on page* 88)

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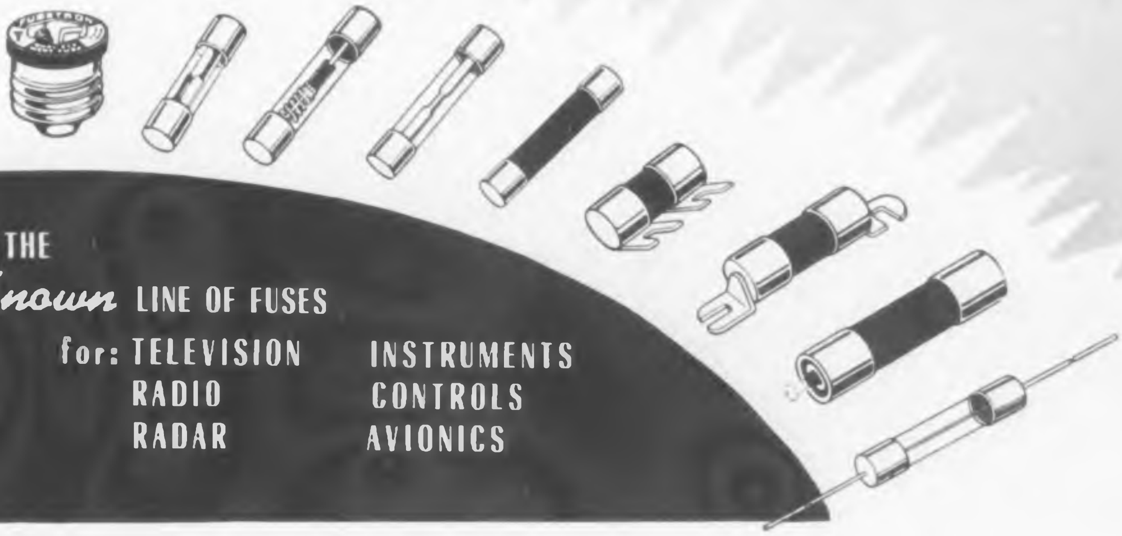

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38 year's service to American homes, farms and industry is behind every fuse that bears the BUSS trademark. Your customers have confidence in BUSS . . . they know the BUSS name represents fuses of unquestioned high quality.

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IF YOU HAVE A PROTECTION PROBLEM — We welcome requests for help in selecting the fuse or fuse mounting best suited to your conditions. Submit sketch or description showing type of fuse contemplated, number of circuits, type of terminals, and the like. Our staff of fuse engineers is at your service.

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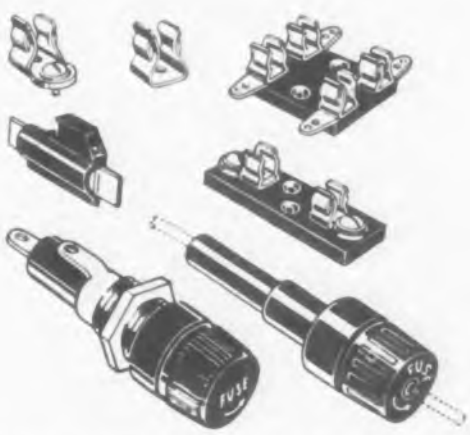
A COMPLETE LINE OF FUSE CLIPS, BLOCKS AND HOLDERS



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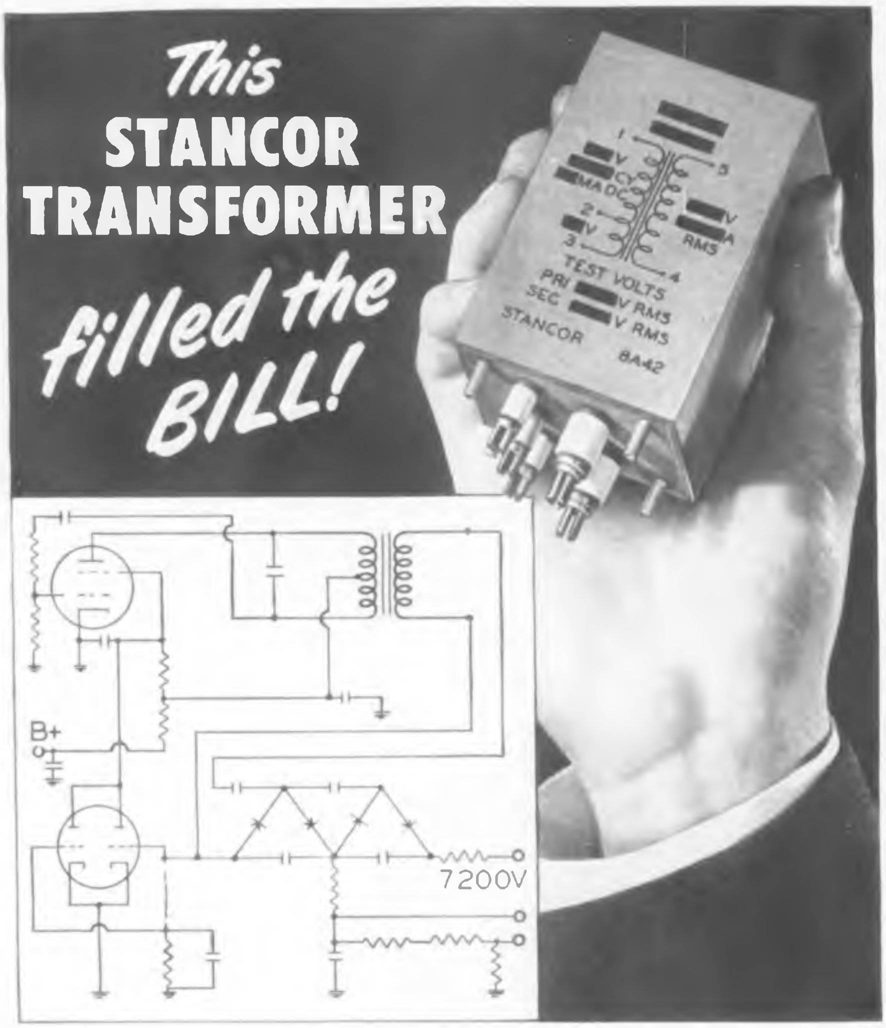

Problem: √ To design and build a transformer to operate in an oscillating circuit at 1500 CPS.

√ Output voltage through a voltage quadrupler is to be 7200V ± 5% at 20 microamperes load.

√ Oscillating frequency and output voltage must remain stable from -40°C to 65°C and the unit must meet the requirements of MIL-T-27, grade 1, Class A, specifications for hermetically sealed transformers.

Solution: STANCOR TRANSFORMER 8A42

For the Answer to Your Toughest Problems of Transformer Design, Consult Stancor Engineers!

Stancor welcomes troublesome problems of transformer design, like the one illustrated, as a responsibility of leadership. We have the necessary engineering skill and resources, backed by in-plant facilities for qualification testing of MIL-T-27 transformers. Next time you're faced with a transformer design problem, let our engineers offer you a quick, practical solution.

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STANDARD TRANSFORMER CORPORATION
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At moderate cost, laboratory standards are available with accuracies of 1 part in 10^5 or better.

Cost Factor Same

On the basis of the above, it is reasonable to conclude that frequency can be measured at present to about 100 times the accuracy of voltage amplitudes. For practical measurements, the cost of the two is approximately the same. There are good reasons for the inherent superiority of frequency standards, based on the fact that frequencies can be multiplied or divided by extremely accurate methods. This property allows direct comparison of our primary frequency standards with very stable processes, such as the rotation of the earth or atomic and molecular motions. As yet, we have discovered no method of amplifying small energy changes by exact factors to give us comparable standards of voltage or current.

Part Two will appear in the November issue.

New NBS Booklet on Capacitor Paper Available

The new 10-page National Bureau of Standards Circular 532, *Measurement of the Thickness of Capacitor Paper,* by Wilmer Souder and S. B. Newman, is available from the Government Printing Office, Washington 25, D.C., for $.15. The circular discusses the applications, limitations, instruments and data analysis involved in three measuring methods: 1) Direct observation across an edge section by a micrometer microscope; 2) Measuring the separation of two geometric surfaces between which specimens are placed; and 3) Determining the mass of an area and computing thickness by means of a density parameter.

Test Equipment by Lloyd's Enterprises

Lloyd M. Jones, with KFI AM-FM-TV for 19 years and with KTTV for 1½ years as operations engineer left KTTV the latter part of September to embark upon his own manufacturing business. The business will be known as LLOYD'S ENTERPRISES, Box 313, Altadena, Calif.

During the war he was with the Radiation Lab., Mass. Inst. of Tech., Cambridge, Mass., as a staff member. Projects included APG-1, APG-5, APG-8 and APG-15. He was with the XX Bomber Command in India and the Pacific during the latter part of the war as Liaison to General Curtis LeMay.

Test equipment for TV and electronic research will be entirely new types, not intended to compete with present types of equipment on the market.

4th Annual AES Convention

The fourth annual convention of the Audio Engineering Society will be held in conjunction with the Audio Fair at the Hotel New Yorker in New York City from October 29 to November 1. More than 100 manufacturers are participating with exhibits of professional and high fidelity audio equipment. Theme of the Fair is "Audio Today and Tomorrow."

The AES annual banquet will take place on Thursday Oct. 30 at 7:30 PM. There will be a binaural broadcast over station WQXR (AM & FM) from 9:05 to 9:30 PM. Among the technical papers scheduled for presentation are:

- Binaural Disc Recording, Emory Cook, Cook Labs.
- Methods of Measuring Surface Induction of Magnetic Tape, J. D. Bick, RCA Victor Div.
- A New Magnetic Recording Tape, Edward Schmidt, Reeves Soundcraft Corp.
- Constant Current Operation of Power Amplifiers, Howard T. Sterling, Waveforms, Inc.
- A New Pocket Wire Recorder, O. Read, Radio and Television News
- Musical Therapy, R. L. Cardinell, Magnetic Programs Inc.
- Gun Shot Reinforcers and Synthesisers, J. L. Hathaway, NBC.
- The Deposited Carbon Resistor, L. B. Keim, Audio Consultant.
- Electrolytic Capacitor, Why & When, Mark Vanbuskirka, P. R. Mallory & Co., Inc.
- Choice of Tubes for Audio Circuits, W. R. Ayres, RCA Victor Div.
- Review of New Printed Circuit Development and Audio, Frequency Application, A. W. Kelly, Jr. Photocircuits Corp.
- Measurement of Non Linear Distortion, A. Bolch, Audio Instrument Co. Inc.
- Distortion in Phonograph Reproduction, H. E. Roys, RCA Victor Div.
- Basic Problems in Audio Systems Practice, W. E. Stewart, RCA Victor Div.
- Audio Frequency Input Circuits, W. B. Snow, Vitro Corp. of America.
- Design of Speech Input Colsoles for TV, Robert H. Tanner, Northern Electric Co., Ltd.
- Consideration of Some Factors Concerning The Use of Audio Transformers, W. E. Lehnery, Audio Development Co.
- Bypass and Decoupling Circuits in Audio Design, L. S. Goodfriend, Audio Instrument Co., Inc.

(*Continued on page 106*)

Coupling with S.S.White Flexible Shafts Adds Flexibility to Your Designs!

The diathermy unit above shows how easy it is to control a hard-to-get-at circuit element from a conveniently placed control knob by means of an S.S.White flexible shaft. The shaft, which is especially designed for remote control duty, would, in fact, provide smooth, responsive tuning regardless of the relative location of the coupled parts.

By planning to use S.S.White flexible shafts as couplings between variable elements and their control knobs, you can get far greater flexibility in designing electronic equipment. Control knobs can be located wherever desired for better appearance, more convenient grouping and easier manipulation. Variable elements can be mounted to satisfy circuit, wiring and assembly requirements. Yes, when it's a question of control think of S.S.White flexible shafts.

SEND FOR THIS 256-PAGE FLEXIBLE-SHAFT HANDBOOK

Complete, authoritative information on flexible shaft construction, selection and application. Copy sent free if you write us direct on your business letterhead, giving your title. There's no obligation.

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DENTAL MFG. CO.

Dept. Q, 10 East 40th St.
NEW YORK 16, N. Y.

Western District Office • Times Building, Long Beach, California

Core Materials

(*Continued from page 42*)

tra-thin material have been made by a technique using ceramic spools on which the material is wound. The magnetic material and spool as a unit is annealed at the required high temperature to obtain the desired magnetic quality. Only a few turns of steel are used on each spool, but it is important that these few turns be well insulated from each other, and techniques of using magnesia powder for this purpose have been developed. The coil windings are put on this core by a toroidal winding machine.

As electronic circuit development proceeds, these ultra-thin magnetic cores present a wide variety of possibilities. They have the big advantage in magnetic amplifier and

Fig. 8: Cores of Hiperthin 1/8-mil steel are wound on ceramic spools and then spot-welded

magnetic flip-flops in that they are far more rugged than vacuum tubes, require no replacement, and do not deteriorate in quality, thus insuring maintenance of accuracy.

After World War II and before the present emergency, some steps were taken to introduce these new developments in standard apparatus for commercial purposes, and great improvements were made, notably toward greater economy. A typical example of the start of this type of development was the application of five-mil Hipersil cores in the deflection yoke of a commercial TV receiver and the incorporation of standard Hipersil cores into the design of the power transformer for the receiver. This work had barely been started before the present emergency was upon us, but it did show that there are distinct performance and economy possibilities.

1. C. C. Horstman, "Electrical Steel for Transformers—Thinner and Better," Westinghouse Engineer, July, 1944, p. 120.
2. J. K. Hodnette and C. C. Horstman, "Hipersil, A New Magnetic Steel and Its Use in Transformers," Westinghouse Engineer, August, 1941, p. 52.

PERSONAL

Arthur C. Omberg has assumed the directorship of engineering and research of the Bendix Radio Div. of Bendix Aviation Corp. He succeeds W. L. Webb who has been promoted to the company's central engineering staff.

Vice Admiral Carl F. Holden, USN (ret.) has been elected president of Federal Telecommunication Laboratories, Inc., Nutley, N. J., research unit of I. T. & T. He has had extensive operational experience in communications, having served in 1942 and 1943 as Director of Naval Communications.

Holden

Bretz

Karl E. Bretz has been named executive vice president of Skottie Electronics, Inc., Peckville, Pa., manufacturers of ceramic, disc, plate and tubular capacitors. He was formerly affiliated with the Hi-Q div. of Aerovox Corp., Olean, N. Y.

B. J. Garnett has been appointed assistant chief engineer of the airborne equipment div. of G. M. Giannini & Co., Pasadena, Calif.

Clyde R. Dupree has been named a development engineer for J. A. Maurer, Inc., Long Island City 1, N. Y., manufacturers of professional motion picture cameras and accessories.

Thomas Murphy has become chief engineer of the Condenser Products Co. Company headquarters are at 7517 N. Clark St., Chicago 26, Ill.

James B. Lindsay, formerly vice president of Thomas Electronics, Inc., has been appointed special engineering representative of the Kahle Engineering Co., North Bergen, N. J.

C. P. Boggs has been appointed vice president in charge of manufacturing of the Brush Development Co., Cleveland, Ohio. He will direct all manufacturing activities of Brush products including industrial and research instruments, acoustic devices, magnetic recording equipment and piezo-electric crystals and ceramics.

Kenneth B. Boothe has been elected a vice president of Audio & Video Devices Corp., 730 Fifth ave., New York 19, N. Y. He was formerly manager of the company's instrumentation div.

Dr. Yuen T. Lo has been appointed project engineer of Channel Master Corp., Ellenville, N. Y.

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- THEY CUT PRODUCTION COSTS!
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New *Bond* Precision Wire Wound Axial Lead Resistors

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Another "beat" by Bond! Here at last, is a true axial lead resistor with completely non-corrosive joints without the use of solders or fluxes. All the quality features and durability of Bond's widely acclaimed resistors . . . with new and ingenious innovations assuring better, longer performance! Protection plus . . . the new Bond resistors are absolutely protected from chassis or mounting surface, due to the true axial termination—affording greater dielectric path. Guaranteed to exceed the requirements for JAN R-93 type RB-51.

Bond resistors are made to all standard tolerances and are wound in a wide range of alloys to meet requirements of varying resistance values. They are built to customer specifications and Bond facilities are available for making the following custom-built coils:

Size Range Of The New Bond Axial Lead Resistors:

BOND TYPE	OVER-ALL LENGTH INCHES	OVER-ALL DIA. INCHES	RESISTANCE RANGE MIN. OHMS	RESISTANCE RANGE MAX. MEG OHMS	POWER RATING COMM.	POWER RATING JAN.	JAN. EQUIV. TYPE
1515	11/16	3/8	1.0	0.42	1/3	1/4	RB51
1516	1 1/16	3/8	1.0	0.85	1/2	1/4	RB51
1517	1 5/16	3/8	1.0	1.25	1.0		
201	1 1/16	7/16	1.0	1.15	3/4	1/4	RB51

Note: All Bond Resistors are impregnated to meet JAN-R-93 specifications.

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For more than 18 years, Eclipse-Pioneer has been a leader in the development and production of high precision synchros for use in automatic control circuits of aircraft, marine and other industrial applications. Today, thanks to this long experience and specialization, Eclipse-Pioneer has available a complete line of standard (1.431" dia. X 1.631" lg.) and Pygmy (0.937" dia. X 1.278" lg.) Autosyn synchros of unmatched precision. Furthermore, current production quantities and techniques have reduced cost to a new low. For either present or future requirements, it will pay you to investigate Eclipse-Pioneer high precision at the new low cost.

*REG. TRADE MARK BENDIX AVIATION CORPORATION

AVERAGE ELECTRICAL CHARACTERISTICS—AY-200 SERIES**

	Type Number	Input Voltage Nominal Excitation	Input Current Milliamperes	Input Power Watts	Input Impedance Ohms	Stator Output Voltages Line to Line	Rotor Resistance (DC) Ohms	Stator Resistance (DC) Ohms	Maximum Error Spread Minutes
Transmitters	AY201-1	26V, 400~, 1 ph.	225	1.25	25+j115	11.8	9.5	3.5	15
	AY201-4	26V, 400~, 1 ph.	100	0.45	45+j225	11.8	16.0	6.7	20
Receivers	AY201-2	26V, 400~, 1 ph.	100	0.45	45+j225	11.8	16.0	6.7	45
Control Trans-formers	AY201-3	From Trans. Autosyn	Dependent Upon Circuit Design				42.0	10.8	15
	AY201-5	From Trans. Autosyn	Dependent Upon Circuit Design				250.0	63.0	15
Resolvers	AY221-3	26V, 400~, 1 ph.	60	0.35	108+j425	11.8	53.0	12.5	20
	AY241-5	1V, 30~, 1 ph.	3.7	—	240+j130	0.34	239.0	180.0	40
Differentials	AY231-3	From Trans. Autosyn	Dependent Upon Circuit Design				14.0	10.8	20

**Also includes High Frequency Resolvers designed for use up to 100KC (AY251-24)

AY-500 (PYGMY) SERIES

	Type Number	Input Voltage Nominal Excitation	Input Current Milliamperes	Input Power Watts	Input Impedance Ohms	Stator Output Voltages Line to Line	Rotor Resistance (DC) Ohms	Stator Resistance (DC) Ohms	Maximum Error Spread Minutes
Transmitters	AY503-4	26V, 400~, 1 ph.	235	2.2	45+j100	11.8	25.0	10.5	24
Receivers	AY503-2	26V, 400~, 1 ph.	235	2.2	45+j100	11.8	23.0	10.5	90
Control Trans-formers	AY503-3	From Trans. Autosyn	Dependent Upon Circuit Design				170.0	45.0	24
	AY503-5	From Trans. Autosyn	Dependent Upon Circuit Design				550.0	188.0	30
Resolvers	AY523-3	26V, 400~, 1 ph.	45	0.5	290+j490	11.8	210.0	42.0	30
	AY543-5	26V, 400~, 1 ph.	9	0.1	900+j2200	11.8	560.0	165.0	30
Differentials	AY533-3	From Trans. Autosyn	Dependent Upon Circuit Design				45.0	93.0	30

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Export Sales: Bendix International Division, 72 Fifth Avenue, New York 11, N. Y.

Transatlantic TV

(*Continued from page 67*)

a must, and other features or specialties quite as well handled in the form of film transported to be scanned. Private backing would further guarantee that the parallel experiences of overseas sound transmission and recording had been fully drawn upon, especially in relation to their time- and frequency-sharing of facilities with overseas telephony and telegraphy.

Everyone connected with international cable and radio communication is bullish about economically increasing the sum total of facilities between the United States and Europe. When something comes long in the form of a radio relay or submarine cable link with a transmission band broad enough for television, it carries potentialities of revolutionizing all overseas communication, whether its realization is brought about by new transistor techniques in direct underwater coaxials or by application of broad-band over-water radio jumps across the Arctic horizons.

You render a public service by keeping attention focussed on the possibilities.

I. S. COGGESHALL
General Traffic Mgr.

Western Union Telegraph Company
New York

Technical Solution Can Be Found

I can see that this could have tremendous possibilities and that if the funds were available a technical solution would be found.

G. E. GUSTAFSON
Vice President in Charge of Engineering

Zenith Radio Corp.
Chicago, Ill.

Military and Other Civil Uses Would Justify Project

While at a first glance Trans-Atlantic TV may appear to be impractical, serious consideration would support the theory that if the economics of a relay system via Canada, Labrador, Greenland, Iceland, etc. can be satisfied, particularly by the inclusion of communication circuits which would provide consistently reliable telegraph and telephone communication, then the overall cost may well be justified.

The international exchange of television programs should be a powerful aid in the promotion of better understanding between continents. International communications require augmentation due to the increase of telephone and telegraph traffic. Militarily the system should have great strategic and tactical value.

I fully concur in your editorial of August 1952 that a competent technical committee should be appointed to investigate the feasibility and cost of a TV Trans-Atlantic system.

A careful study of the technical feasibility and cost of the various systems being considered is necessary in order to establish the most satisfactory route to be utilized.

Considerable work has to be done in the study of propagation factors, in the design and production of equipment capable of handling the wide band widths required with satisfactory commercial signal noise ratios, and reliability of service.

The northern relay route proposed does not present insurmountable obstacles as radio stations have been in existence, staffed and maintained in these regions for many years.

J. J. KINGAN
General Manager

Canadian Marconi Co.,
2442 Trenton Ave.,
Montreal 16, Canada

Despite Difficulties Sees Trans-Atlantic TV a Future Certainty

Your letter addressed to the President and published in your August issue of Tele-Tech is very timely, and the action which you recommend very appropriate.

It is not clear to me what type of programs would profitably be transmitted from Europe to the United States and from the United States to Europe. It is obviously possible to take moving pictures and to televise these. Hence, programs which do not require a contemporary broadcast would not help support the very large expense of a trans-Atlantic link. This might reduce the type of program requiring trans-Atlantic links to political affairs and sports. In the field of sports there is little in common between the United States and Europe. It is possible, of course, that the existence of a television link would alter this situation. In the political field, on the other hand, there is considerable interest. Here again some study would have to be made of the language barrier and also of the time difference. For example, be-

France and the West Coast of the ited States there is a time difference in neighborhood of ten hours. Does this an that the broadcasting of programs m France to the West Coast is unsuitle?

I hope that my comments above will be derstood as constructive. I am sure that ns-Atlantic television will be with us in a t too distant future. Your work in this rection is certainly to be commended.

I. A. GETTING
Vice President
Engineering and Research
aytheon Mfg. Co.
Waltham 54, Mass.

Necessity for UN & NATO

I have had the privilege of following the rowth of the Narcom idea from its incepion and we are glad to see it receive recogition such as you gave it. It is such a big plan that one may be startled by it at first. There are many formidable engineering and conomic problems to be solved before it can be realized, but the value of such a facility should provide the incentives necesary to surmount the remaining problems.

Such a system would be valuable for Europe/America TV exchanges, but its value for other telecommunications, principally telephony, would be even greater. In comparison with our domestic telephony, trans-Atlantic telephony is primitive and inadequate. A radio-relay system of the type envisaged by the Narcom plan appears to offer the first real advancement in method that has been proposed in many years. When it is realized that one good wideband circuit the Atlantic could carry everything that is now transmitted in the 4 to 26 mc band, plus TV programs (on occasion), the economic aspects of such a circuit take on special significance.

Execution of the Narcom plan at this time would be much less adventurous undertaking than was the laying of the first trans-Atlantic cable in its day. We have become accustomed to enormous expenditures for ships of peace and war, planes, trans-Arabian pipe lines, and other great projects, yet vital communications are still largely regarded in small terms. Communications constitute the nerve system of modern civilization, and if that civilization is to be kept stable, communications must keep pace with economic and political growth. The Narcom idea needs to be extended to the whole Western Hemisphere, and if politically possible to Asia. New knowledge of wave propagation and new accomplishments in equipment and operations technology make the prospects of practical realization very hopeful.

The growth of overland microwave techniques has perhaps caused many to think of relaying in terms of milliwatts of power and small-area antennas. The Narcom route would permit a fairly good choice of frequencies and band-widths, and kilowatts of transmitter power with antennas of large area would permit using large enough hops to cover the longer land to land gaps on this route. Should some of these gaps prove insurmountable for an appreciable part of the time, a ship relay may be brought to the rescue.

Cost Not Formidable

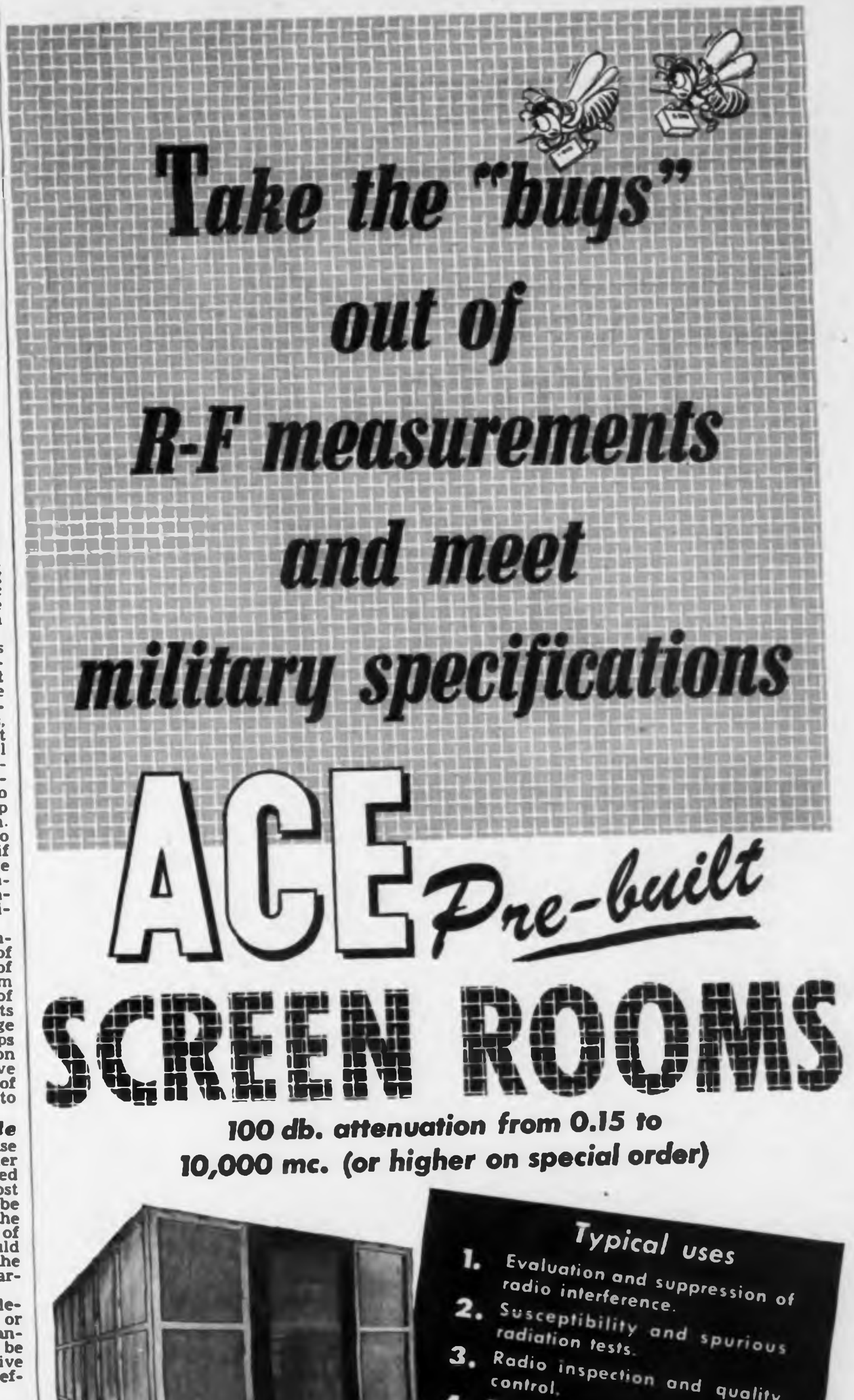
Narcom seems to be a necessity for UN use and for NATO. An investment of the order of magnitude of the cost of the SS "United States" (which is only a fraction of the cost of an aircraft carrier) would seem to be both in the national interest and to the benefit of international relations. The cost of such a system is not so great that it would deter private enterprise from taking on the project if the treaty aspects could be arranged by the countries involved.

Today we need the same quality of telephone service from New York to London, or to Buenos Aires, as we have to San Francisco. If the means existed they would be used. Here is a new challenge to creative effort that can have a highly beneficial effect on government and business.

MEADE BRUNET
V.P. & Managing Director
RCA International
Division, 30 Rockefeller
Plaza, New York 20

Air Force Receives Global Network Transmitters

Westinghouse Electric Corp., Baltimore, Md., reports the delivery of $375,000 worth of radio transmitters for the USAF global network project. These transmitters will be part of a world-wide communications network for ground-to-ground and ground-to-air contact with any Air Force base in the world. Built to radiate signals up to 000 miles, the transmitters have a frequency range of 2 to 30 MC.



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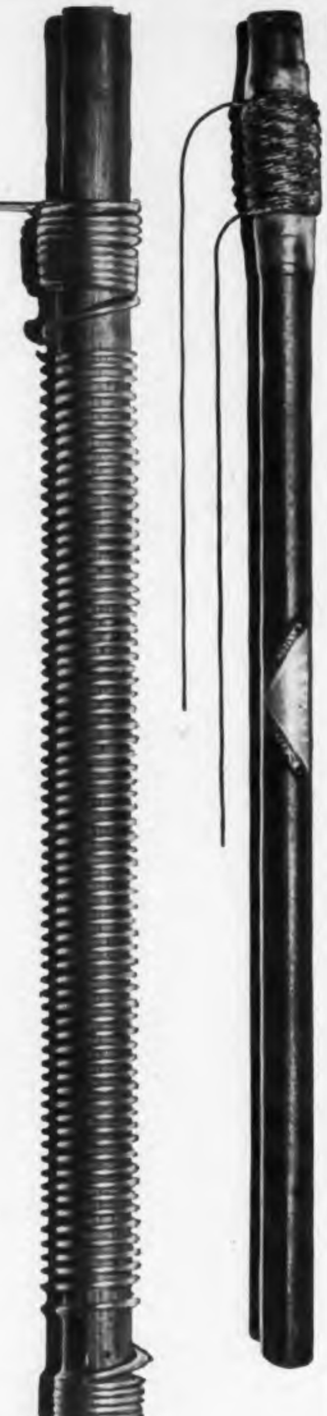

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Silk Screen

(Continued from page 63)

quantity of the paint across the silk screen stencil with a single stroke of a rubber squeegee. The squeegee serves to force a thin film of paint through the stencil, depositing the pattern on the material being printed. Enamel is a satisfactory etchant resist for etching copper patterns with ferric chloride. It is suggested that the first prints of any stencil be made on paper until the proper sharpness of definition has been achieved. A second resist pattern may be screened over the etched conductors for solder-dip assembly.

Alignment of Pattern

The finished screen and stencil are prepared for printing by first carefully locating the register guides. These are small pieces of material of the same thickness as the material to be printed, and are carefully taped or fastened to the printing base to guide the placement of the material to received printing (Fig. 6). To locate the register guides, a piece of the base material is selected as a sample and is carefully located on the printing base in such a position that when the screen is brought down the stencil is in exactly the desired location. Two or more register guides are then carefully taped into position along any two adjacent sides of the samples. With these register guides each successive piece will then be printed with the pattern of circuitry in exactly the same location. After the registers have been placed the screen may be masked.

Masking

Masking is done by cutting a piece of heavy Kraft paper to fit inside the screen; then, by holding the screen to the light, an area may be traced 2 in. larger than the stencil pattern in each dimension. This area is removed. The remaining sheet of paper is securely taped into place. Masking tape should be applied completely around the outer edges of the paper, sealing it to the frame. Tape is also used to hold down the edges of the paper around the stencil. Tape 0.75 or 1.0 in. wide should be used and kept at least 0.5 in. back from any of the patterned circuitry of the stencil. Masking is done to prevent a loss of paint through the open areas of the screen outside the stencil.

Regardless of printing medium used (enamels, asphaltum, conductive paints, resistor inks, etc.), it must be used freely as a lack of sufficient medium will cause drying and clogging of the screen and yield imperfect prints.

The printing medium should be poured into the screen across one end of the stencil but not over any part of the pattern. The squeegee is brought down behind the paint and then brought across the stencil with a smooth steady motion (Fig. 7). If the paint is of the proper consistency a single stroke of the squeegee will usually produce a print of the finest definition. It may be found necessary to hold down the finished print when the screen is raised. This may be done by fastening a piece of tape under the printed material, adhesive side up. Commercially, vacuum arrangements are used to hold the pattern down during this release step.

Assuming the stencil to be adequate, there are two factors which greatly influence the quality of the prints. These are: (1) the sharpness, pressure and slant of the squeegee, and (2) the consistency of the paint. Also the bottom portion of the rubber squeegee should be cut sharply at a right angle and have sharp straight edges.

The squeegee pressure and slant must be determined by experience since they vary with each type of printing medium. A fairly light pressure with a 15° forward slant will usually produce satisfactory results.

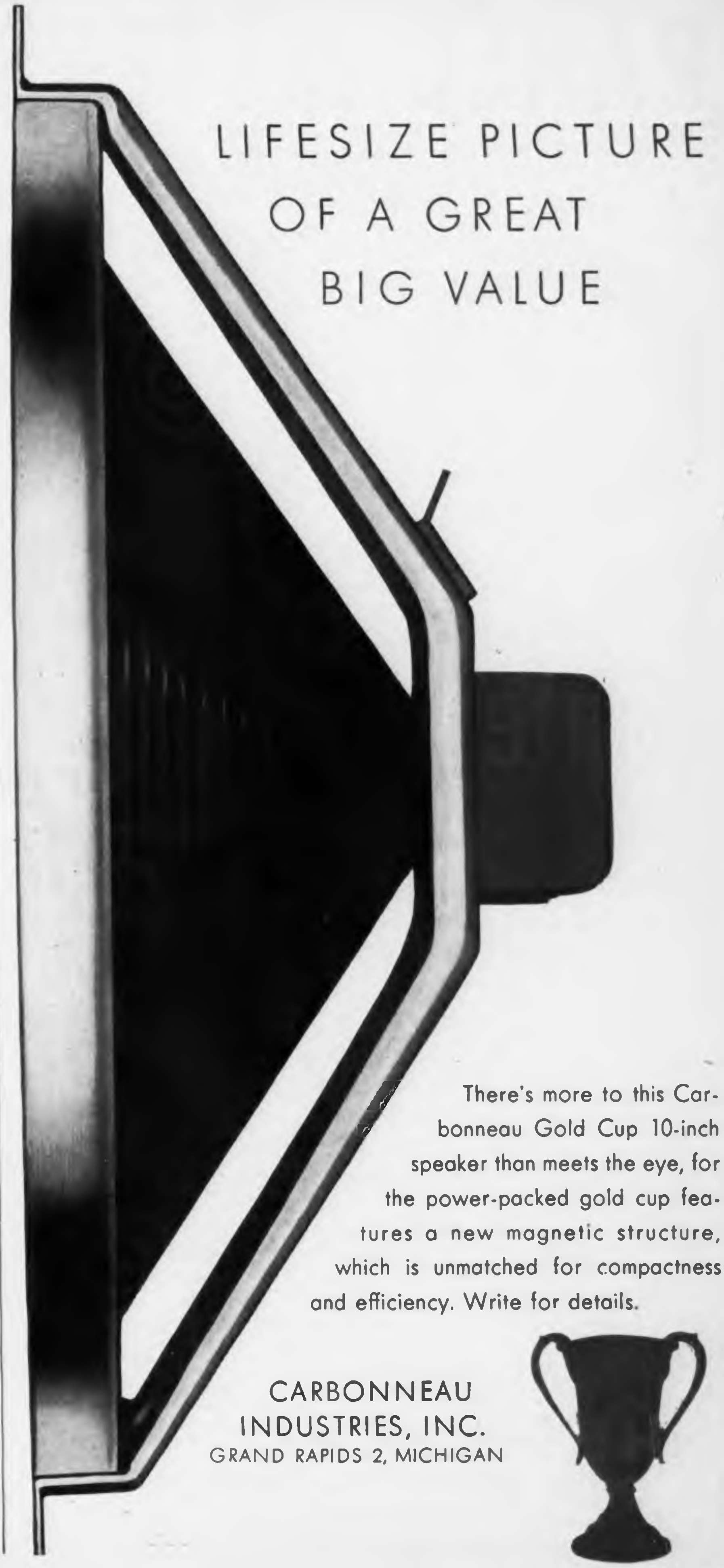
Paint Consistency

The viscosity of the paint is one of the most sensitive variables in good silk screen printing. A less viscous medium will produce a quicker drying print and will result in less screen clogging, but may produce more blots and smears. A paint that is thick will usually produce sharp clear prints but may display more mesh marks and unprinted areas with an increased tendency of the printed material to stick to the bottom of the screen.

In printing conductive paints, the thickness of the deposited paint may be controlled by adjusting the consistency and squeegee slant. A thin paint with little squeegee slant will usually result in a thin deposit of paint while a thicker paint with increased slant of the squeegee and light pressure will result in a heavier deposit of conductive paint.

Once printing is started, there should be as little delay as possible between prints. This will help avoid clogging of the screen by drying paint. If the screen should become clogged it may be cleaned either

(*Continued on page* 96)



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entirely or in part with the appropriate paint thinner. After printing the prints may be either air or oven dried.

Silk screen printing of a resist pattern by the hand methods described herein is most practical for the printing of small or medium quantities where the cost of setting up the more elaborate processes would be prohibitive. Silk screening is especially suitable for the production of laboratory development models of prefabricated conductor patterns where small quantities and frequent changes requiring pattern revisions are involved.

Field Strength Meters

(*Continued from page* 46)

reflect radio signals. Such a rite was selected at Hybla Valley, Va. The setup is for the employment of both induction and radiation components of the standard field using horizontal polarization. Two posts are located 100 ft. apart and antenna masts provide for mounting the two antennas at ten-foot heights above the ground. The standard receiving antenna is a half-wave dipole which has been shortened slightly for self-resonant operation. It is constructed of small dural tubing, giving a large ratio of length to diameter. The transmitting antenna is similar to the receiving antenna and the associated equipment is housed in a small frame building about 200 ft. away. The building was specially constructed to contain a minimum of metal.

A standard signal generator, vacuum-tube voltmeter monitor, and balun similar to those used in the other tests on VHF field-strength meters are used at the field site. A portable heterodyne frequency meter is used in maintaining the frequency within about ±0.1%. The balun is located immediately under the transmitting antenna and its output is connected through a balanced transmission line to the antenna input.

Voltage Measurements

The voltage induced in the standard receiving antenna by the standard field is measured with a balanced crystal voltmeter. The voltmeter consists of a type 1N28 crystal rectifier mounted in the center of the dipole antenna. The dc output is filtered by an RC network and measured by means of a portable precision potentiometer. For each day's test the crystal must be calibrated to determine the relationship between its dc output and r-f input. The ini-

(*Continued on page* 99)

tial r-f calibrating voltage to the crystal is determined by use of a calibrated 5-ma r-f vacuum thermo-element. The signal generator is tuned to about 50 or 100 MC. Its output is attenuated in 3-db intervals by the standard piston attenuator used in the other tests. A balun converts to balanced output. This output is applied to the thermo-element. The crystal is connected across the thermo-element input through disc-type dc isolation capacitors. Portable precision potentiometers are used to measure the dc ouptputs of the thermo-element and the crystal. Fig. 4 shows the arrangement of the equipment for this test.

Antenna Rods

Prior to beginning tests for determining the antenna coefficient of VHF field-strength meters, antenna rods of the proper length must be prepared for each frequency at which coefficient measurements are to be made. Although the transmitting antenna rods are not critical, they are made the same length as the receiving rods for convenience. Proper rods for the frequency to be used are put into place on the antenna mounts. Clamps on the antenna posts automatically align the antennas properly when the masts are put into place. A third mast is provided for mounting the antenna of the field-strength meter. VHF field-strength meters employ half-wave dipole antennas having adjustable rods.

The signal generator is tuned to the desired frequency and connected to the transformer or balun. The transmitting antenna and the field-strength meter's antenna are mounted on their respective posts. The field-strength meter is located about 20 ft. away in line with the antenna, so that the observer will have minimum distorting effect upon the field. The portable potentiometer used to measure the crystal output is located nearby and is connected to the crystal through an ordinary twin-lead insulated line. The equipment arrangement is shown in Fig. 5.

With its antenna adjusted to the proper length, the field-strength meter is tuned to the signal frequency and adjusted for normal gain. The generator output is adjusted to give a convenient reading on the output meter of the field-strength meter. This reading is observed. The antenna is replaced by the standard receiving antenna and crystal output is observed. This is repeated at each frequency where an antenna coefficient is desired.

(Continued on page 100)

Medical Color TV

CBS has announced the appointment of Wilmot Castle Co., Rochester, N.Y., as exclusive sales agents of their industrial color TV system for medical applications. The equipment has already been installed at the U. of Chicago, U. of Kansas, U. of Penna., and at a European location.

The camera is mounted in the center of a cluster of four special lights, suspended over the operating table and focused on the operating field. The TV camera is remotely controlled from a booth overlooking the operating room. Closed circuits carry the scene to various locations in the hospital for instructional and supervisory purposes. A small microphone and headphone inside the surgeon's mask permits oral description by him, and queries from the distant audience. A senior surgeon can monitor the operation from his office and speak privately to the operating surgeon over a separate audio system. The complete color TV camera and control equipment is approximately one-quarter of the size of present-day monochrome studio equipment.

Philco Appoints Radio VP

William H. Chaffee has been appointed vice-president of Philco's newly-formed Radio Div., headed by Larry F. Hardy, president of the division. Mr. Chaffee was named vice-president and director of purchases of Philco Corp. in 1949, and elected to the Board of Directors in 1950.

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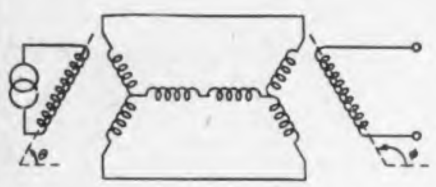

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The foregoing procedure applies to field-strength meters whose attenuators are in the i-f section of the instrument. In the case of field-strength meters having attenuators in the r-f circuit, antenna coefficients must be determined at each frequency for each position of the r-f attenuator. This presents the difficulty of requiring very small values of field strength at the lower attenuator steps, fields which are below the useful range of the standard receiving antenna and crystal voltmeter setup. For this test the equipment is connected as before (Fig. 5) with one exception: the vacuum-tube voltmeter is replaced by a monitoring circuit consisting of a VHF radio receiver and a high-frequency, decade-type standard attenuator. The VHF receiver is connected through the standard attenuator to the output of the generator.

With the field-strength meter set to its highest r-f attenuator position, a field-strength measurement is made in the same manner as before. The standard attenuator is set for maximum attenuation and the VHF receiver tuned to a reference indication. The field is then reduced to one-tenth of its original value by removing 20 db of attenuation from the standard attenuator and readjusting the generator output until the VHF receiver returns to the reference point. Further reductions in the field can be made in the same way over a range of 1000 to 1.

Antenna Coefficient

The antenna coefficient is computed from the measurements by the formula $K = E/MA$, where

K = Antenna coefficient
E = Field strength, μv/m
M = Output meter reading
A = Attenuator setting.

Corrected values of output meter readings and attenuator ratios as determined in the two previous tests are used in the computations. From the calibration curve of the crystal, the voltage induced in the standard antenna for each value of crystal output is obtained. The field strength, E, is determined by the induced voltage and the effective length of the antenna. Thus, $E = V/L_H$, where

E = Field strength, μv/m
V = Open-circuit voltage induced in the standard receiving antenna measured at the center, μv.
L_H = Effective length of receiving antenna, meters.

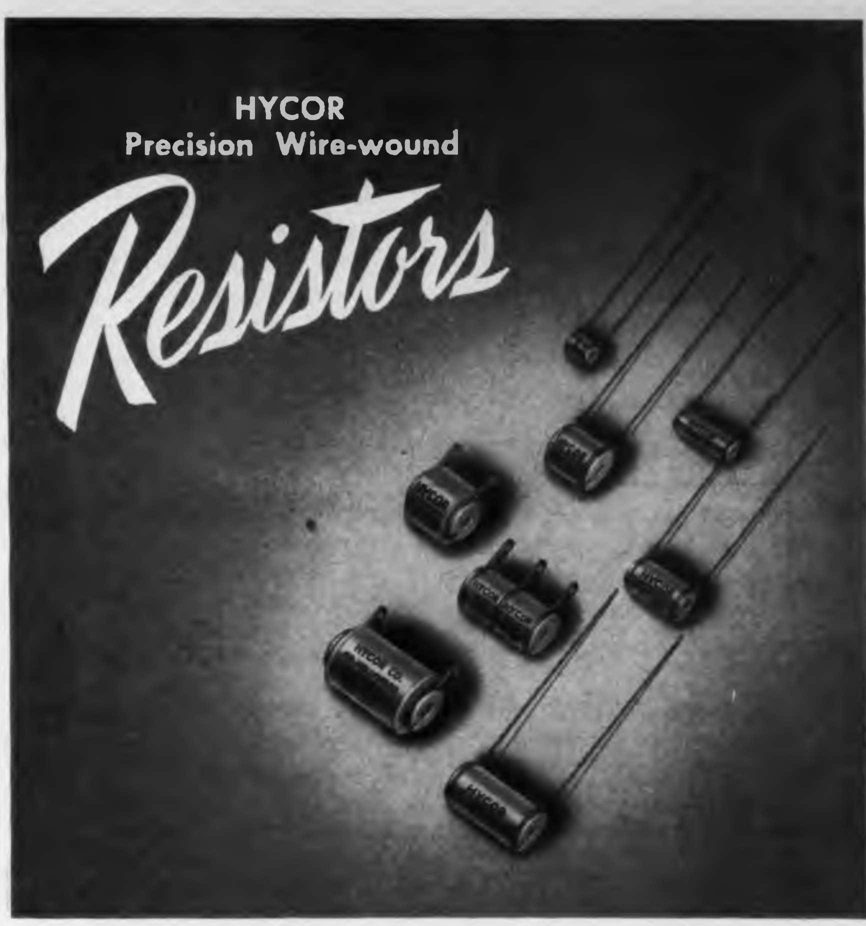
Effective length of a transmitting antenna is defined as the length of an antenna which, if carrying a uniform current equal to the current flowing at the reference point of the actual antenna, will produce the same field strength as the actual antenna. The effective length is unchanged if the antenna is used as a receiving antenna. The effective length of the standard antenna used is approximately the same as for an infinitely-thin halfwave dipole, i.e., λ/π meters. This results from the nearly equal and opposite effects of the finite antenna diameter on the current distribution and on the physical shortening for self-resonant operation.

A brief history and description of the calibration services for commercial field-strength meters offered by NBS have been given. The usual calibration consists of determining the overall linearity, attenuator ratios, and antenna coefficients of the instrument. Overall linearity and attenuator ratio measurements are certified to ±2% from 10 KC to 300 MC. Antenna coefficients are certified as follows: loop antennas, ±3% from 10 KC to 5 MC and ± 5% from 5 MC to 30 CM; dipole antennas, ±10% from 30 to 150 MC and ±15% from 150 to 300 MC.

1. F. M. Greene and M. Solow, "Development of Very-High-Frequency Intensity Standards," **J. Research NBS RP 2100, 44**, pp. 527-547, May 1950.
2. IRE Standards on Radio Wave Propagation (Measuring Methods), pp. 1-8, 1942.
3. F. M. Greene, "The Influence of the Ground on the Calibration and Use of VHF Field Intensity Meters," **J. Research NBS** RP 2062, **44**, pp. 123-130, Feb. 1950.

BRITISH TV STATION

The Wenvoe (South Wales) transmitter, fifth and latest of the BBC's high power TV transmitters which will bring programs to viewers in the West of England and South Wales. As of Aug. 15, BBC programs were reported to be available to 78% of the U.K. population.



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Second Detector S/N

(*Continued from page* 56)

Noise Improvement Ratio (NIR) is

$$NIR = \frac{\sqrt{B_r}}{\left\{1 + \frac{2}{N_o\left[N - \frac{(\overline{V'^2_{ac}})^{\frac{1}{2}}}{(\overline{V^2_{ac}})^{\frac{1}{2}}}\right]}\right\}} \quad (3)$$

where N_o is the ratio of average peak output noise to rms output noise, N is the signal-to-noise ratio defined above, $(\overline{V'^2_{ac}})^{1/2}$ is the rms component of the noise on top of the pulse, and $(\overline{V^2_{ac}})^{1/2}$ is the rms component of the noise on the base line.

It is emphasized that the second detector does not itself produce an improvement in signal-to-noise ratio. Its function is to set up the conditions for signal-to-noise improvement by converting part of the noise energy into a dc voltage which can be readily eliminated from the output of the receiver.

Detector & Video Amplifier

At the input to the detector the noise is assumed to be "white," i.e., having a uniform spectrum within the i-f pass band, but after passage through the detector, beating of the harmonic components of the noise takes place, producing a triangular power spectrum at the output with the apex of the triangle at zero frequency, declining to zero power density at a frequency equal to the bandwidth of the i-f amplifier. The video amplifier affects this noise in two ways. It amplifies, and, unless video bandwidth is as wide as the i-f bandwidth, it filters out the higher harmonic components of the noise. In practical receivers the maximum bandwidth of the video amplifier does not exceed half the i-f amplifier bandwidth; hence filtering of the noise will occur. Although the video amplifier also filters out some of the very low frequency components of the noise signal, the output is not appreciably affected thereby except for filtering out the dc component of noise voltage.

Filter and Detector

It is convenient to consider the filter action of the video amplifier and the detector action of the second detector jointly. Let $V_{nif}(t)$ represent the noise output from the i-f amplifier, which output is presumed to be uniform in frequency over a relatively narrow bandwidth $(f_b - f_a)$. (By relatively narrow is meant a center frequency between f_a and f_b which is of the order of ten times $(f_b - f_a)$. The power density of the noise is equal to W_o in this band and

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7	60	cps
4	50	cps
2	10	cps

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to zero outside it. The approximate expression for the power density of the continuous noise spectrum in the low frequency band is

$$W_c(f) = \frac{W_0}{4\pi}\left[1 - \frac{f}{(f_b - f_a)}\right]$$

for

$$0 \leq f \leq (f_b - f_a)$$

The mean squared component of the low frequency noise is

$$\overline{V_{ac}^2} = \int_0^{f_c} W_c(f)\,df$$

where f_c is the cutoff frequency of the video amplifier. Since

$$\overline{[V_{nif}(t)]^2} = W_0 (f_b - f_a)$$

$$\overline{V_{ac}^2} = \frac{f_c}{8\pi (f_b - f_a)}\left[2 - \frac{f_c}{(f_b - f_a)}\right] \cdot \overline{\left[V_{nif}(t)\right]^2} \qquad (4)$$

It is seen that Eq. (4) is the same as Eq. (2) to good approximation when $f_c = (f_b - f_a)$, i.e., when the video amplifier passes all of the harmonic components of the noise. At first sight it may be puzzling that apparently two different approaches should give essentially the same answer. Actually, these two approaches are one and the same. The theory from which Eqs. (1) and (2) are derived also accounts for the triangular noise spectrum. The only point of interest is that when determining the filtering action of the video amplifier, it is convenient to work with the equivalent power density spectrum from which the mean-squared noise voltage is obtained.

With reference to the video amplifier, there is one more consideration. In Eq. (4), $\overline{V_{ac}^2}$ is the mean-square low frequency noise appearing at the output of a network consisting of a linear detector followed by a low pass filter with a cutoff frequency equal to that of the video amplifier. To obtain the rms noise appearing at the output of the video amplifier, $(\overline{V_{ac}^2})^{1/2}$ is multiplied by the voltage gain of the video amplifier. Thus the rms noise voltage at the output of the receiver (output of the video amplifier) is

$$\left(\overline{V_{acv}^2}\right)^{1/2} = G_v \left(\overline{V_{ac}^2}\right)^{1/2} \qquad (5)$$

The specification of receiver sensitivity is designed to insure a given operation, but a knowledge of receiver noise figure will tell whether such operation is practicable. For example, one sensitivity specification for a radar receiver states in effect: "For an output pulse signal plus peak noise to peak noise ratio of 5 volts to 1 volt the input signal level to the receiver shall be 89 db below 1 volt." For this specification to be met, the noise figure of the receiver

(Continued on page 104)

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cannot exceed a certain value. If this maximum noise figure is too low to be achieved by the techniques available to the "state of the art," then the receiver with the required sensitivity cannot be built. Unless a detailed analysis of noise at the various functional levels of the receiver can be made from design considerations, the only recourse is to construct the receiver and try it out. A frequently used method for estimating receiver noise figures gives erroneous results because it fails to take account of the improvement possibilities provided by the second detector.

This method consists in noting the specified signal-to-noise ratio at the output of the receiver and the specified input signal required to produce this signal-to-noise ratio. Then the ratio of the input signal to minimum theoretical noise is calculated, and the ratio of this quantity to the output signal-to-noise ratio is taken as the noise figure of the receiver. The method overlooks the division of noise in the output of the second detector into dc and ac components, a division which results in a favorable signal-to-noise indication in the output. Consequently, the noise figure of the receiver obtained by this method is better than the actual noise figure. To what extent this is true in an actual case is discussed in an example given later.

Receiver Noise Figure

Fig. 1 represents an installation for measuring receiver noise figure. The usual procedure is to read on the noise meter the noise output of the receiver for zero output from the diode noise generator. Then the output of the noise generator is increased until the reading on the noise meter is doubled. When this happens, the noise introduced to the input terminals of the receiver by the noise generator must equal the equivalent input noise of the receiver itself. As the noise generator is calibrated, the equivalent input noise voltage of the receiver is thus determined. The db ratio of the output noise voltage as read on the noise meter to this equivalent input noise voltage is the noise figure of the receiver in db.

Fig. 2 shows a pulse signal in the presence of receiver thermal noise as displayed on an oscilloscope. The relation between average peak noise and rms noise is indicated.

Once the properties of the noise in the second detector and video amplifier have been described, a summation of noise levels throughout the receiver is then straightforward. By recording noise levels at various stages in the receiver, beginning with the specified output noise, it is possible to obtain a value for the input noise which is equivalent to the noise locally generated in the receiver. This input noise can then be compared with minimum theoretical noise to obtain the receiver noise figure. At the input terminals of the receiver the equivalent rms noise voltage is

$$\overline{[V_{nrf}(t)]^2}^{\frac{1}{2}} = \frac{K\, L_p\, \hat{V}_{acv}}{N_o\, G_v\, G_{if}}$$

where

$$K = \left\{ \frac{8\pi (f_b - f_a)}{f_c \left[2 - \frac{f_c}{(f_b - f_a)} \right]} \right\}^{\frac{1}{2}}$$

L_p is the loss factor in the preselector, $\hat{V}_{acv}$ is the average peak noise at the output of the video amplifier as read on an oscilloscope, N_o is the ratio of average peak ac output noise to rms output noise, G_v is the voltage gain in the video amplifier, and G_{if} is the voltage gain in the i-f amplifier. The ratio of the noise voltage in Eq. (6) to the minimum theoretical noise voltage in rms volts (calculated for the noise bandwidth which is approximately the i-f amplifier bandwidth) is the noise figure of the receiver. The difference of the noise voltage in Eq. (6) and the theoretical noise voltage, both expressed in db, is the noise figure of the receiver in db.

Sample Calculations

The relation for the "noise improvement ratio" is given in Eq. (3). Assume that the ratio of signal plus average peak noise to average peak noise is 5 and that the average peak noise is 1. A frequently used value for N_o is 2.5, so that $(\overline{V_{ac}^2})^{\frac{1}{2}}$ is 0.4. Suppose also that $\hat{V}_s$ is estimated to be 4. The ratio $(\overline{V'^2_{ac}})^{\frac{1}{2}}/(\overline{V_{ac}^2})^{\frac{1}{2}}$ is found to be about $\sqrt{2}$. Hence,

$$NIR = \frac{\sqrt{8\pi}}{\left[1 + \frac{2}{2.5(5 - 1.41)}\right]} = 4.1, \text{ or about 12 db noise improvement}$$

The noise level at the input to the receiver is obtained from Eq. (6):

$$20 \log_{10} \overline{[V_{nrf}(t)]^2}^{\frac{1}{2}} = 20 \log_{10} \left[\frac{K\, L_p\, \hat{V}_{acv}}{N_o\, G_v\, G_{if}}\right]$$

In the case of an actual receiver the parameters are: $L_p = 1.2$ (1.5 db); $\hat{V}_{acv} = 1$ volt (average peak level); $N_o = 2.5$ (8 db); $G_v = 3.2$ (10 db); $G_{if} = 3.8 \times 10^5$ (110 db) $(f_b - f_a) =$ 8 MC (i-f bandpass); and $f_c = 2.5$ MC (video cutoff).

These parameters, with two exceptions, can be written down from a mere perusal of the specification. For example $\hat{V}_{acv}$ is directly specified. The required overall gain can be deduced readily from the specification of sensitivity. G_{if} and G_v can

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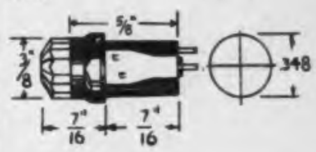

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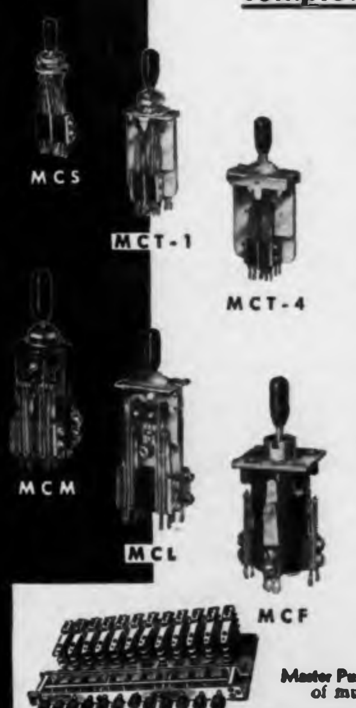

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then be assigned more or less arbitrarily, provided their total contribution to gain is consistent with the required overall gain, any special receiver requirements, and sound technical practice. The quantity $(f_b - f_a)$ is specified directly, and f_c is inferred from the pulse output rise time requirement. The two exceptions are N_o which is a constant, independent of the receiver, and L_p (the loss factor in the preselector) whose value can be assigned, to good approximation, from past experience.

In the construction of this receiver it proved advantageous to have a voltage stepdown between the output of the second detector and the video amplifier of 4 to 1. This does not, however, alter the assignment of the above parameters except that in effect we assign 12 db less gain to the i-f amplifier. If we compute the equivalent noise voltage at the input to the receiver, taking the values of the parameters as listed and including the 4 to 1 stepdown, we have the following:

$$K = \left[\frac{8\pi \times 8}{2.5\left(2 - \frac{2.5}{8}\right)}\right]^2 = 6.9$$

$$20 \log_{10} \overline{[V_{nrf}(t)]^2}^{\frac{1}{2}} = 20 \log_{10} \left[\frac{6.9 \times 1.2 \times 4 \times 1}{2.5 \times 3.2 \times 3.2 \times 10^5}\right]$$

$$= 98 \text{db below 1 v. rms}$$

This noise level must be compared with minimum theoretical noise to obtain the noise figure of the receiver. The minimum theoretical noise is obtained from the relation:

Minimum Theoretical Noise Power $= K\ T\ (\Delta f)_{NBW}$ where $(\Delta f)_{NBW}$, the noise bandwidth of the receiver, is approximately given by the i-f bandwidth. Since $K = 1.37 \times 10^{-23}$ watts sec/cycle deg.; $T = 290°$ Abs.; and $(\Delta f)_{NBW} = 8$ MC: Minimum Theoretical Noise Power $= 1.38 \times 10^{-23} \times 290 \times 8 \times 10^6 = 3.1 \times 10^{-14}$ watts $= 135$ db below 1 watt $= 118$ db below 1 v rms (assuming 50 ohm resistor).

Thus, the equivalent noise at the input to the receiver is 20 db above minimum theoretical noise, and this is the noise figure of the receiver. It is possible to check this with the aid of available receiver noise data (for a receiver which employs a 1N72 crystal as converter, the characteristics of which are similar to those for a 1N25) and the formula for receiver noise figure:

$$20 \log_{10} NF \text{ (Receiver)} = 20 \log_{10} L_c\,[t + (N_{if} - 1)]$$

where $N_{if} = 2$ (6 db); $t = 2.5$ (8 db), the crystal noise temperature; and $L_c = 2.5$ (8 db), conversion loss.

Thus, $20 \log_{10}$ NF (Receiver) = 18.9 db. This agrees rather well with

AES Program

(Continued from page 89)

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the noise figure of 20 db as obtained above.

It is interesting to compare this result with the noise figure of the receiver obtained by the method mentioned previously, which neglects division of noise into ac and dc components in the detector output. The signal-to-noise ratio at the output of the receiver is approximately 12 db for a signal plus average peak noise to average peak noise ratio of 5 to 1. The noise level is 1 v. Thus, the signal is 20 db above rms noise. At the input to the receiver the corresponding signal is specified as 89 db below one volt (matched load). This is 29 db above minimum theoretical noise level. But since the signal at the output is 20 db above rms noise, the net increase in relative noise is 9 db, so, according to this method, the noise figure of the receiver is 9 db which does not agree with the experimentally determined value.

Conclusion

Quantitative relations have been derived from which the noise figure of a receiver can be calculated, knowing only the specified receiver sensitivity and the gain and loss parameters of the receiver. The theory is checked against measured data on a pulse receiver, and there is found to be good agreement with the receiver noise figure computed from measurement of the noise figure of the i-f amplifier, and data on the conversion loss and noise temperature of the crystal converter. The ability to estimate receiver noise figures correctly from design considerations alone is important because we can then state whether or not the specification of receiver sensitivity is realistic in advance of construction. Moreover, the noise figure can be readily computed, thus dispensing with the need for a noise generator and noise meter.

This paper was presented at the National Electronics Conference in Chicago, Oct. 1951.

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"RESERVISOR"

(Continued from page 57)

two main parts, an address storage section and an inventory storage section, Fig. 3. Each plate has reserved for it 64 spots on the drum where the addresses for the inventories on that plate are stored. It should be noted that this enables one inventory or flight to appear on several plates as the same address may be stored in several spots. The inventory section is referenced only by the address stored in the address section of the drum and, therefore, one address will imply only one inventory. Since the plates are used on any date of the ten day storage period, this one address may imply one of ten inventories, depending on the date used. From this, it is seen that the address for an inventory must be read before an inventory may be read. Each drum will hold approximately 200,000 digits and rotates at 1200 rpm.

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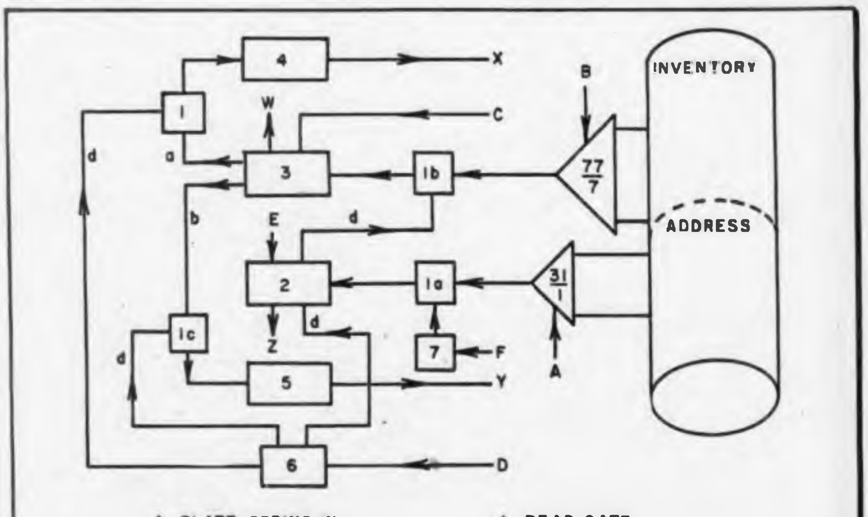
The programming is standard and slight variations are set up for one of three types of calls when that call comes in. See Fig. 4. The three most common call types are an availability check, a sale, and a cancellation. The following is a brief description of the operations performed by the machine for each call.

Availability: This first implies that eight flight legs or inventories will be inspected. Read address for leg 1; open gate 1a into register 2 at proper time. Read inventory for leg 1; open gate 1b per address. From this subtract the number of seats (C) requested. If the remainder is greater than or equal to zero, remember leg 1, that is, line *a* into register 4. Read address leg 2. Read inventory leg 2, etc., until leg 8 is finished. Stop and send out legs whose remainder was greater than or equal to zero, output X, as an answer.

Sell call: This implies that one or more, up to eight, legs or inventories will be looked at, e.g., two legs. The machine operations (see Fig. 4) are: Read address for first leg. From this subtract seats requested. If the remainder is greater than or equal to zero, go to second leg. If the remainder is greater than or equal to zero, go back to first leg and read address. Read inventory and from it subtract the number of seats requested. If the remainder is zero, line *b*, remember which leg it is by opening gate 1c to register 5. Write the remainder into the drum at the address of the first leg. Read out the remainder just written and check. Read address for second leg and so on as in the first leg. Stop. If zero was the remainder on any leg, send Post signal (flights sold out) and leg number to posting printer, output Y. On a cancellation, the same operation is done but the number of seats

Fig. 4: Functional diagram of computer system shows how availability data is obtained from drum



are added to the inventory instead of being subtracted. Information coming from the drum is at a 20 KC rate.

Design Considerations

Maintenance and reliability were the main considerations in design. All working components, such as tubes, resistors, capacitors, and diodes are mounted in functional sub-assemblies and are easily interchanged. There are about 35 different types in the total 500 sub-assemblies such as, gates, counters, matrix, and binary arithmetic units. Some interesting statistics of the Reservisor central office equipment are: 5,000,000 soldered connections, 150 yards of coaxial cable, 1500 vacum tubes, 44 mi. of wire, and 1400 relays. Normal total power consumption is 6.45 kw.

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Special features to the system include an instantaneous printed record of the flights that have been sold out. This is called a posting. One agent set near the loading gate is able to read the exact number of seats that are left on a plane at any particular time. At midnight one of the ten days of storage has gone out of date and, therefore, it is necessary to use the drum storage for the new tenth day. Under normal conditions this would mean that 1000 new inventories would have to be written into the drum. To avoid this time consuming task, a standard inventory for each of the 1000 inventories is stored in what is referred to as the Advanced Day Storage. Once every night the Advance Day inventories are copied into the new tenth day. On an average day, the reservisor handles about 22,000 calls into the machine, most of them occurring in a ten hour period.

New Standard Coil Plant

Standard Coil Products Co., Inc. has announced the purchase of approximately four acres of plant development ground adjoining the present plant in the Melrose Park District of Chicago. A 70,000 sq. ft. addition to the present 40,000 sq. ft. building is planned.

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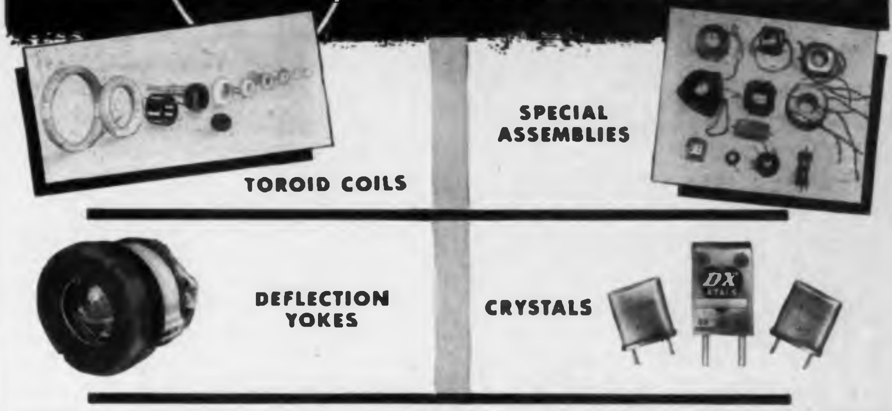

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MAGNETRON TEST

(Continued from page 37)

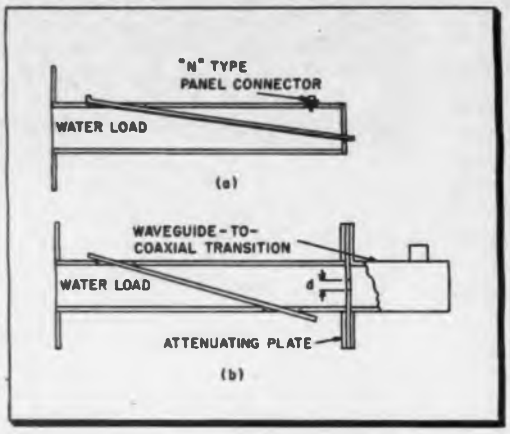


Fig. 5: (l) Two methods of sampling r-f in water load systems. Fig. 6: (r) R-F power monitor

pressing devices. The TE_{O11} mode is particularly useful in these cylindrical cavity resonators, since it does not require an electrical short between the tuning plunger and the cylinder walls. The details of design will not be described here, since they are a straightforward application of conventional procedures employing a so-called mode chart. Based on *Technique of Microwave Measurements*, by C. G. Montgomery, an S-band wavemeter with an average dispersion of 0.25 MC/0.001 in. has been constructed with a ratio of $(D/L)^2 \sim 3$. The same design point has been used for an X_B-band wavemeter with a dispersion of 1.0 MC/0.001 in.; while an X-band wavemeter with an average dispersion of 0.25 MC/0.001 in. was based on a $(D/L)^2$ ratio of 0.5.

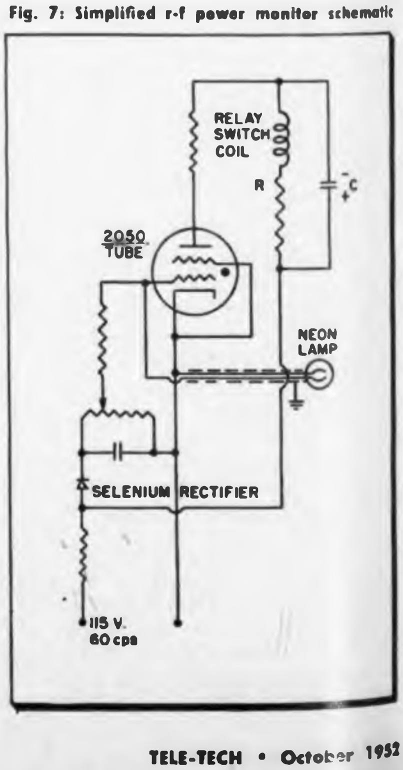
R-F Power Monitor

It may be desirable, particularly during unattended life-test runs of magnetrons, to monitor the microwave power output of the magnetron oscillator and to disconnect the high-voltage circuits (power supply, modulator) whenever the magnetron output power falls below a specified level. This can be accomplished by means of the compact monitor unit shown in Fig. 6, the essential components of which are illustrated in Fig. 7. In this device, a neon bulb is used as the r-f power-sensitive element.

The circuit consists of a thyratron tube with a 60 CPS signal applied to its plate. The neon bulb, placed near the magnetron transmission line and connected to the monitor unit by means of a shielded two-wire cable, is ionized by the leakage r-f power radiated from the water load. When ionized, the neon bulb removes the dc bias voltage from the thyratron control grid so that thyratron plate current is permitted to flow. Whenever the r-f power level in the waveguide transmission line diminishes to the point at which the neon bulb is extinguished, a dc bias voltage appears on the thyratron grid, plate current ceases to flow, and the relay switch placed in series with the thyratron plate opens the circuits controlled by the monitor unit.

It is usually desirable to incorporate in the design of the unit a time delay of the order of, say, one second between the instant the neon bulb is de-ionized and the time when the switching action of the relay occurs, to guard against the test station being shut off owing to momentary arcing of the magnetron. This delay time can be controlled by the RC

Fig. 7: Simplified r-f power monitor schematic



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- "Q" rating of over 1000 at 1 mc.
- Dielectric strength equals 1000 volts DC at sea level pressure and 500 volts at 3.4 inches of mercury.
- 10,000 megohms insulation resistance minimum.
- Operating temperatures, —55 C. to +125 C. with glass dielectric. And —55 C. to +200 C. with quartz dielectric.
- Over 100 megohms moisture resistance after 24 hours exposure to 95% humidity at room temperature.

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combination in the thyratron plate circuit shown in the diagram.

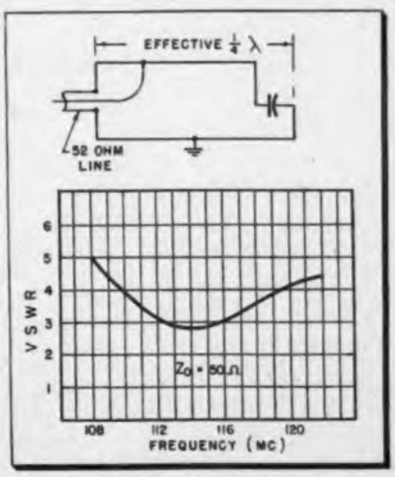
The examples of specific microwave devices employed in the testing of magnetrons have served, it is hoped, to illustrate the method of approach, which is to make use of the relatively high power levels and the limited range of operating frequencies peculiar to magnetron oscillators. The proper use of these, and similar, instruments may greatly reduce testing time on a magnetron test facility called upon to handle appreciable quantities of magnetron tubes and serviced by semi-skilled operators.

ODR ANTENNA

(*Continued from page* 59)

Antenna AT-(XA-109)/ARN-14 is a special Omni-Directional Range Receiving antenna for use with Radio Set AN/ARN-14 in F-90 aircraft. It

is in the experimental development category. It operates over the frequency range of 108 through 122 MC, and is horizontally polarized. RG-8/U or similar 52 ohm coaxial cable is used in connecting the antenna to the radio set. One antenna is installed on each side of the nose of the F-90 aircraft and the two are fed in phase opposition through a balun, thus obtaining 360°



aircraft pattern coverage. This zero-drag antenna is described in USAF Specification No. X-7197. Weight of the unit is 8 lbs. Its size is: overall length, 26 in.; overall width, 18 in.; overall depth, 7 in.; length of element, 23 in.; and width of element, 7 in.

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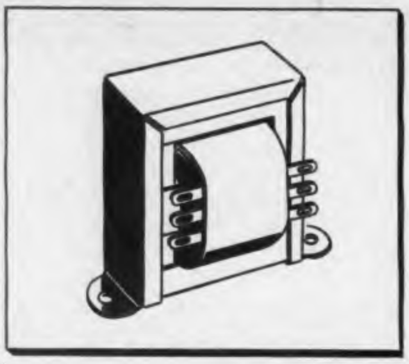
Transformers

Two line-to-voice coil transformers for 70.7 v. line audio distribution systems are designed in accordance with RTMA specifications. The transformers, listed as Stancor Part Nos. A-8102 and A-8103, will operate into load impedances of 4, 8 or 16 ohms and from 70.7 v. or one or more of the speaker-distribution-line voltages in a series derived by the successive multiplication or division or 70.7 v. by $\sqrt{2}$. The power taken from the line by each primary tap when the transformer is properly terminated in its rated



impedance falls in a series based on one watt and proceeding upward and downward in 3 db steps.—**Standard Transformer Corp., 3580 Elston Ave., Chicago, Ill.**—TELE-TECH

Dual Regulated Power Supply

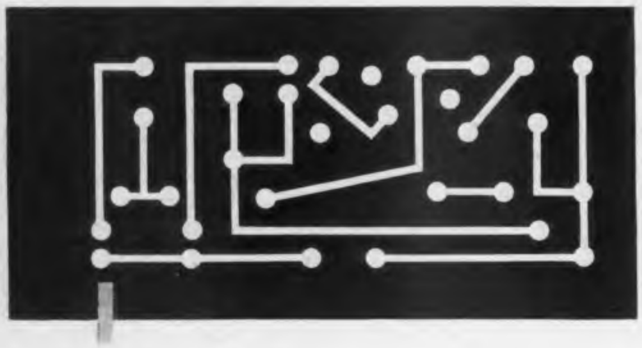
Model D4 regulated power supply provides two completely independent outputs, each continuously variable from 0 to 400 v. with

0.5% regulation at loads from 0 to 200 ma. At the users wish, the two outputs may be paralled to double the output current or seriesed to double the output voltage. Also featured are two continuously variable bias supplies of 0 to -150 volts dc stabilized. Ripple of all the outputs is less than 10 mv. Separate meters monitor output voltage and current of each supply.—**Oregon Electronic Mfg. Co., 2232 East Burnside St., Portland 15, Ore.**—TELE-TECH

Glide Path Test Set

Model AEC-170 glide path receiver test set is a battery operated portable oscillator which provides a crystal controlled signal at

332.6, 333.8 or 335 MC. If desired, 30% modulation from internal source at 90, 150 or 1000 CPS is available for glide path channels GX, GY and GZ. Suitable for operation in or out of cockpit up to 50 ft. from receiver antenna, attenuator output is 50,000 μv. maximum, 100 μv. minimum. Power is supplied by two 45-v. B batteries and two 6-v. A batteries. Twenty pound instrument measures 9 x 12.25 x 6.75 in. Total price FOB factory is $321.00. Company is also producing TS/67-C-1 ILS signal generators, power supplies, radio transmitters, mobile receivers, and VHF antennas.—**American Electroneering Corp., 5025-29 W. Jefferson Blvd., Los Angeles 16, Cal.**—TELE-TECH



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Designed also as a compilation of "end products," this Equipment Directory includes listings of all major replacement parts for communication equipment. Manufacturers who build and design government and military equipment are also presented.

FOR ALPHABETICAL LIST OF MANUFACTURERS SEE PAGE 119

PRODUCT INDEX OF MANUFACTURERS

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To this two-section unit you can add as many console sections (for "on-air" monitor, preview monitor, individual camera monitors) as you need to take care of your individual requirements. In this way you can build up a "centralized" control position from which one man can (if necessary) perform all operations.

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The basic TC-4A (left-hand and center sections) with a master monitor (right-hand section) as normally used at the transmitter (i.e., no video origination at this location).

The same setup with a film camera control unit added (at the left) for programming of slides and films from the transmitter—or for small stations without "live" studios.

-4A Control Console (3rd and 4th units from left) combined with three monitor sections to provide complete station operating control from a position in the transmitter room. In this arrangement the first unit of the console (starting from the left) is the "live" camera control and monitor, the second is a film camera control, the third unit contains audio faders and audio and video switching, the fourth unit contains monitor switching and remotely located equipment controls, the fifth unit is the line master monitor. Audio and video amplifiers, power supplies, etc., are mounted on the racks at left (shown shaded). The transmitter in the background is the Type TT-2A 2 kw, VHF TV Transmitter. However, the same arrangement of controls and audio-video facilities can, of course, be used with any RCA TV transmitter, UHF or VHF, 500 watts to 50,000 watts (providing ERP's of 1 kw to 1000 kw).

TC-4A with master monitor unit, preview monitor unit, and two camera control units (one live and one film or two film). If desired, sections can be arranged U-shape or L-shape to fit available space.

Similar setup with two camera control units (one live and one film, or two film), such as used in the RCA "Basic Buy" for TV.

then be assigned more or less arbitrarily, provided their total contribution to gain is consistent with the required overall gain, any special receiver requirements, and sound technical practice. The quantity ($f_2 - f_1$) is specified directly, and f_c is inferred from the pulse output rise time requirement. The two exceptions are N_o which is a constant, independent of the receiver, and L_p (the loss factor in the preselector) whose value can be assigned, to good approximation, from past experience.

In the construction of this receiver it proved advantageous to have a voltage stepdown between the output of the second detector and the video amplifier of 4 to 1. This does not, however, alter the assignment of the above parameters except that in effect we assign 12 db less gain to the i-f amplifier. If we compute the equivalent noise voltage at the input to the receiver, taking the values of the parameters as listed and including the 4 to 1 stepdown, we have the following:

$$K = \left[\frac{[illegible]}{2.5\left(2 - \frac{2.5}{8}\right)}\right]^2 = 6.9$$

$$20 \log_{10} \sqrt{\overline{V_{if}(t)^2}} = 20 \log_{10}\left[\frac{6.9 \times 1.2 \times 4 \times 1}{2.5 \times 3.2 \times 3.2 \times 10^5}\right]$$

$= 98$ db below 1 v. rms

This noise level must be compared with minimum theoretical noise to obtain the noise figure of the receiver. The minimum theoretical noise is obtained from the relation:

Minimum Theoretical Noise Power $= K\ T\ (\Delta f)_{NBW}$ where $(\Delta f)_{NBW}$, the noise bandwidth of the receiver, is approximately given by the i-f bandwidth. Since $K = 1.37 \times 10^{-23}$ watts sec/cycle deg.; $T = 290^\circ$ Abs.; and $(\Delta f)_{NBW} = 8$ MC: Minimum Theoretical Noise Power $= 1.38 \times 10^{-23} \times 290 \times 8 \times 10^6 = 3.1 \times 10^{-14}$ watts $=$ 135 db below 1 watt $=$ 118 db below 1 v rms (assuming 50 ohm resistor).

Thus, the equivalent noise at the input to the receiver is 20 db above minimum theoretical noise, and this is the noise figure of the receiver. It is possible to check this with the aid of available receiver noise data (for a receiver which employs a 1N72 crystal as converter, the characteristics of which are similar to those for a 1N25) and the formula for receiver noise figure:

$$20 \log_{10} NF\ (\text{Receiver}) = 20 \log_{10} L_c\ [t + (N_{if} - 1)]$$

where $N_{if} = 2$ (6 db); $t = 2.5$ (8 db), the crystal noise temperature; and $L_c = 2.5$ (8 db), conversion loss.

Thus, 20 $\log_{10}$ NF (Receiver) $=$ 18.9 db. This agrees rather well with

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RMS In Larger Quarters

RMS has moved to a new location at 2016 Bronxdale Ave., New York 60, N. Y., the site of a former sports club. The modern structure provides 45,000 sq. ft. of space for the firm's electronics production. The company's Antenna Div. will remain at West Farms Rd. in the Bronx.

the noise figure of 20 db as obtained above.

It is interesting to compare this result with the noise figure of the receiver obtained by the method mentioned previously, which neglects division of noise into ac and dc components in the detector output. The signal-to-noise ratio at the output of the receiver is approximately 12 db for a signal plus average peak noise to average peak noise ratio of 5 to 1. The noise level is 1 v. Thus, the signal is 20 db above rms noise. At the input to the receiver the corresponding signal is specified as 89 db below one volt (matched load). This is 29 db above minimum theoretical noise level. But since the signal at the output is 20 db above rms noise, the net increase in relative noise is 9 db, so, according to this method, the noise figure of the receiver is 9 db which does not agree with the experimentally determined value.

Conclusion

Quantitative relations have been derived from which the noise figure of a receiver can be calculated, knowing only the specified receiver sensitivity and the gain and loss parameters of the receiver. The theory is checked against measured data on a pulse receiver, and there is found to be good agreement with the receiver noise figure computed from measurement of the noise figure of the i-f amplifier, and data on the conversion loss and noise temperature of the crystal converter. The ability to estimate receiver noise figures correctly from design considerations alone is important because we can then state whether or not the specification of receiver sensitivity is realistic in advance of construction. Moreover, the noise figure can be readily computed, thus dispensing with the need for a noise generator and noise meter.

This paper was presented at the National Electronics Conference in Chicago, Oct. 1951.

Heyer Forms New Division

Heyer Products Co. of 471 Cordtland St., Belleville, N.J. announces the establishment of an electronic division to be headed by J. A. Van Auken, formerly with General Electric and Utility Electronics Corp. Previously Heyer Products manufactured for its own use only, but now engineering and manufacturing facilities for the production of transformers, meters, relays, switches and complete harnesses will be made available to the electronic industries.

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"RESERVISOR"

(*Continued from page* 57)

two main parts, an address storage section and an inventory storage section, Fig. 3. Each plate has reserved for it 64 spots on the drum where the addresses for the inventories on that plate are stored. It should be noted that this enables one inventory or flight to appear on several plates as the same address may be stored in several spots. The inventory section is referenced only by the address stored in the address section of the drum and, therefore, one address will imply only one inventory. Since the plates are used on any date of the ten day storage period, this one address may imply one of ten inventories, depending on the date used. From this, it is seen that the address for an inventory must be read before an inventory may be read. Each drum will hold approximately 200,000 digits and rotates at 1200 rpm.

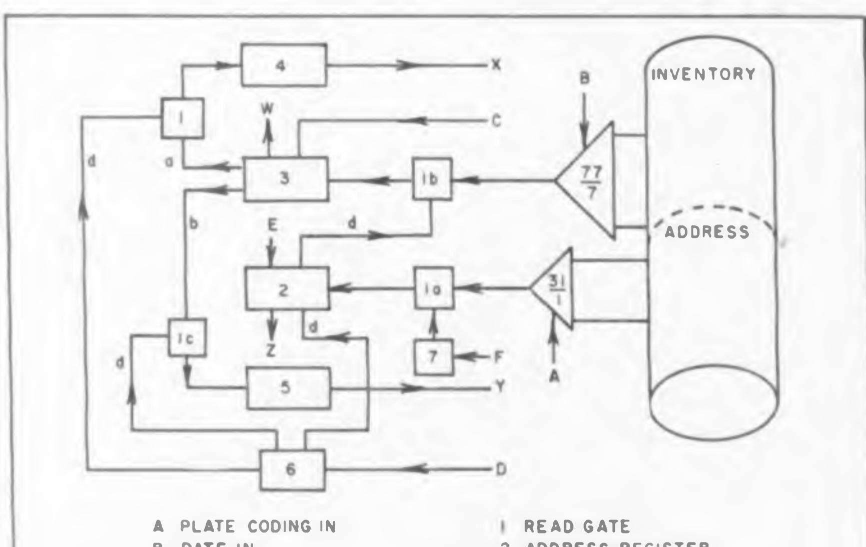
Programming Standard

The programming is standard and slight variations are set up for one of three types of calls when that call comes in. See Fig. 4. The three most common call types are an availability check, a sale, and a cancellation. The following is a brief description of the operations performed by the machine for each call.

Availability: This first implies that eight flight legs or inventories will be inspected. Read address for leg 1; open gate 1a into register 2 at proper time. Read inventory for leg 1; open gate 1b per address. From this subtract the number of seats (C) requested. If the remainder is greater than or equal to zero, remember leg 1, that is, line *a* into register 4. Read address leg 2. Read inventory leg 2, etc., until leg 8 is finished. Stop and send out legs whose remainder was greater than or equal to zero, output X, as an answer.

Sell call: This implies that one or more, up to eight, legs or inventories will be looked at, e.g., two legs. The machine operations (see Fig. 4) are: Read address for first leg. From this subtract seats requested. If the remainder is greater than or equal to zero, go to second leg. If the remainder is greater than or equal to zero, go back to first leg and read address. Read inventory and from it subtract the number of seats requested. If the remainder is zero, line *b*, remember which leg it is by opening gate 1c to register 5. Write the remainder into the drum at the address of the first leg. Read out the remainder just written and check. Read address for second leg and so on as in the first leg. Stop. If zero was the remainder on any leg, send Post signal (flights sold out) and leg number to posting printer, output Y. On a cancellation, the same operation is done but the number of seats

Fig. 4: Functional diagram of computer system shows how availability data is obtained from drum



are added to the inventory instead of being subtracted. Information coming from the drum is at a 20 KC rate.

Design Considerations

Maintenance and reliability were the main considerations in design. All working components, such as tubes, resistors, capacitors, and diodes are mounted in functional sub-assemblies and are easily interchanged. There are about 35 different types in the total 500 sub-assemblies such as, gates, counters, matrix, and binary arithmetic units. Some interesting statistics of the Reservisor central office equipment are: 5,000,000 soldered connections, 150 yards of coaxial cable, 1500 vacum tubes, 44 mi. of wire, and 1400 relays. Normal total power consumption is 6.45 kw.

Due to the 24 hour operation only two hours are allowed for the reservisor to be taken out of service for full testing. Each night during this time bias and plate voltages are lowered to produce marginal conditions. In this way, it is possible to replace units before they may cause trouble in service.

Special Features

Special features to the system include an instantaneous printed record of the flights that have been sold out. This is called a posting. One agent set near the loading gate is able to read the exact number of seats that are left on a plane at any particular time. At midnight one of the ten days of storage has gone out of date and, therefore, it is necessary to use the drum storage for the new tenth day. Under normal conditions this would mean that 1000 new inventories would have to be written into the drum. To avoid this time consuming task, a standard inventory for each of the 1000 inventories is stored in what is referred to as the Advanced Day Storage. Once every night the Advance Day inventories are copied into the new tenth day. On an average day, the reservisor handles about 22,000 calls into the machine, most of them occurring in a ten hour period.

New Standard Coil Plant

Standard Coil Products Co., Inc. has announced the purchase of approximately four acres of plant development ground adjoining the present plant in the Melrose Park District of Chicago. A 70,000 sq. ft. addition to the present 40,000 sq. ft. building is planned.

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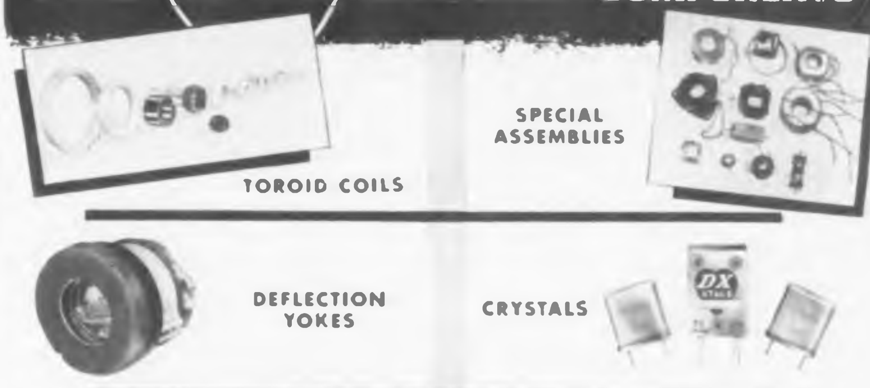

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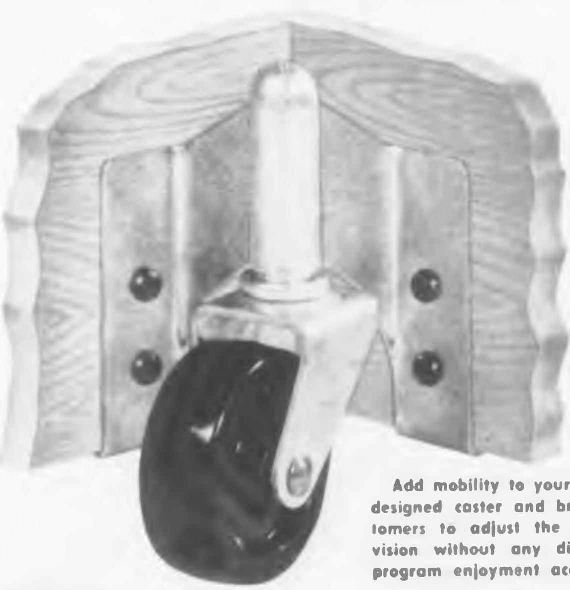

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Add mobility to your TV cabinets with this especially designed caster and bracket. It will enable your customers to adjust the angle of their sets for better vision without any difficulty and will increase their program enjoyment accordingly.

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The Nagel-Chase bracket can be simply attached to practically any cabinet and permits application of casters without additional costly wood construction needed for the ordinary caster socket. The Nagel-Chase caster swivels freely because it bears on the point of the stem instead of the shoulders as ordinary casters do.

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MAGNETRON TEST

(Continued from page 37)

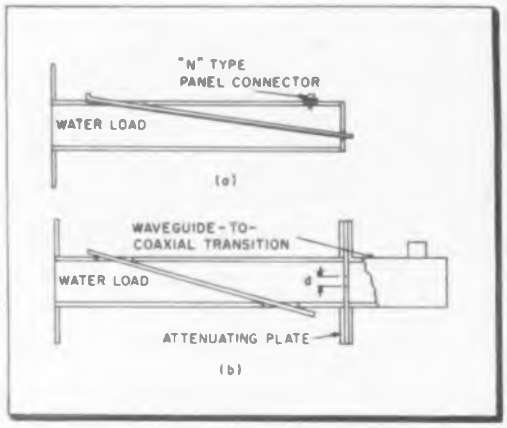


Fig. 5: (l) Two methods of sampling r-f in water load systems. Fig. 6: (r) R-F power monitor

pressing devices. The TE_{011} mode is particularly useful in these cylindrical cavity resonators, since it does not require an electrical short between the tuning plunger and the cylinder walls. The details of design will not be described here, since they are a straightforward application of conventional procedures employing a so-called mode chart. Based on *Technique of Microwave Measurements*, by C. G. Montgomery, an S-band wavemeter with an average dispersion of 0.25 MC/0.001 in. has been constructed with a ratio of $(D/L)^2 \sim 3$. The same design point has been used for an X_n-band wavemeter with a dispersion of 1.0 MC/0.001 in.; while an X-band wavemeter with an average dispersion of 0.25 MC/0.001 in. was based on a $(D/L)^2$ ratio of 0.5.

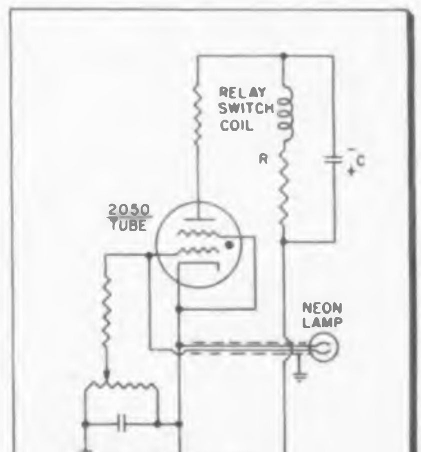
R-F Power Monitor

It may be desirable, particularly during unattended life-test runs of magnetrons, to monitor the micro-wave power output of the magnetron oscillator and to disconnect the high-voltage circuits (power supply, modulator) whenever the magnetron output power falls below a specified level. This can be accomplished by means of the compact monitor unit shown in Fig. 6, the essential components of which are illustrated in Fig. 7. In this device, a neon bulb is used as the r-f power-sensitive element.

The circuit consists of a thyratron tube with a 60 CPS signal applied to its plate. The neon bulb, placed near the magnetron transmission line and connected to the monitor unit by means of a shielded two-wire cable, is ionized by the leakage r-f power radiated from the water load. When ionized, the neon bulb removes the dc bias voltage from the thyratron control grid so that thyratron plate current is permitted to flow. Whenever the r-f power level in the wave-guide transmission line diminishes to the point at which the neon bulb is extinguished, a dc bias voltage appears on the thyratron grid, plate current ceases to flow, and the relay switch placed in series with the thyratron plate opens the circuits controlled by the monitor unit.

It is usually desirable to incorporate in the design of the unit a time delay of the order of, say, one second between the instant the neon bulb is de-ionized and the time when the switching action of the relay occurs, to guard against the test station being shut off owing to momentary arcing of the magnetron. This delay time can be controlled by the RC

Fig. 7: Simplified r-f power monitor schematic



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- "Q" rating of over 1000 at 1 mc.
- Dielectric strength equals 1000 volts DC at sea level pressure and 500 volts at 3.4 inches of mercury.
- 10,000 megohms insulation resistance minimum.
- Operating temperatures, −55 C. to +125 C. with glass dielectric. And −55 C. to +200 C. with quartz dielectric.
- Over 100 megohms moisture resistance after 24 hours exposure to 95% humidity at room temperature.

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combination in the thyratron plate circuit shown in the diagram.

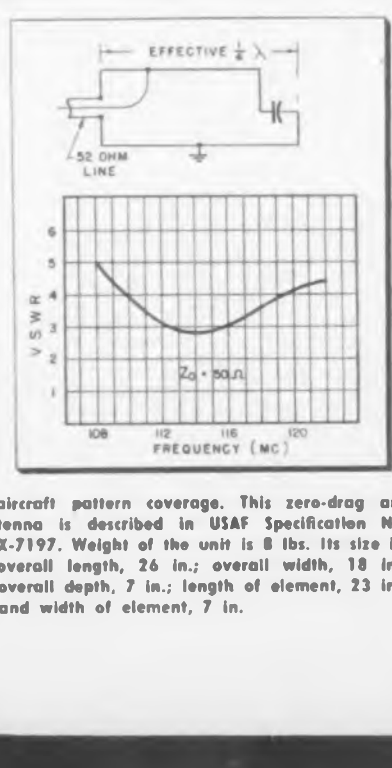
The examples of specific microwave devices employed in the testing of magnetrons have served, it is hoped, to illustrate the method of approach, which is to make use of the relatively high power levels and the limited range of operating frequencies peculiar to magnetron oscillators. The proper use of these, and similar, instruments may greatly reduce testing time on a magnetron test facility called upon to handle appreciable quantities of magnetron tubes and serviced by semi-skilled operators.

ODR ANTENNA

(Continued from page 59)

Antenna AT-(XA-109)/ARN-14 is a special Omni-Directional Range Receiving antenna for use with Radio Set AN/ARN-14 in F-90 aircraft. It

is in the experimental development category. It operates over the frequency range of 108 through 122 MC, and is horizontally polarized. RG-8/U or similar 52 ohm coaxial cable is used in connecting the antenna to the radio set. One antenna is installed on each side of the nose of the F-90 aircraft and the two are fed in phase opposition through a balun, thus obtaining 360°



aircraft pattern coverage. This zero-drag antenna is described in USAF Specification No. X-7197. Weight of the unit is 8 lbs. Its size is: overall length, 26 in.; overall width, 18 in.; overall depth, 7 in.; length of element, 23 in.; and width of element, 7 in.

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VHF CONDENSERS

National VHF condensers feature ball bearings, front and back, for smooth operation and freedom from backlash; exceptionally rigid construction, mounting brackets for 7-pin miniature tube sockets to minimize lead lengths, wide frequency range, silver-plated stators, rotors and connections and shaft extensions at rear for ganging purposes. Both double and single spaced models are available in single or double sections covering all needed ranges. Write for drawings and specifications.

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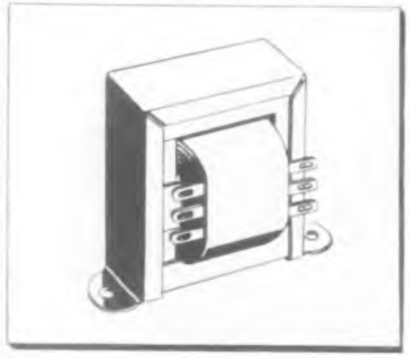
Instrument Microscope

A new wide field microscope of medium power will be useful to instrument makers and the producers of all small components.

The microscope can be attached to any small lathe for inspection of the work in operation. It provides fixed magnification of either 20X or 40X, with or without a reticle. The microscope swings out of work's way without losing focusing adjustment. The flexibility of adjusting it allows the wide field to take in all the work area. Fine focusing by means of a rack and pinion is a feature. The heavily cast aluminum body deadens all lathe vibration. **Pacific Transducer Corp. (formerly Clarkstan Corp.) of 11921 Pico Boulevard, Los Angeles 64, Calif.**—TELE-TECH

Transformers

Two line-to-voice coil transformers for 70.7 v. line audio distribution systems are designed in accordance with RTMA specifications. The transformers, listed as Stancor Part No. A-8102 and A-8103, will operate into load impedances of 4, 8 or 16 ohms and from 70.7 v. or one or more of the speaker-distribution-line voltages in a series derived by the successive multiplication or division of 70.7 v. by [illegible]. The power taken from the line by each primary tap when the transformer is properly terminated in its rated



impedance falls in a series based [illegible] watt and proceeding upward and downward in 3 db steps. **Standard Transformer Corp., 3580 Elston Ave., Chicago, Ill.**—TELE-TECH

Dual Regulated Power Supply

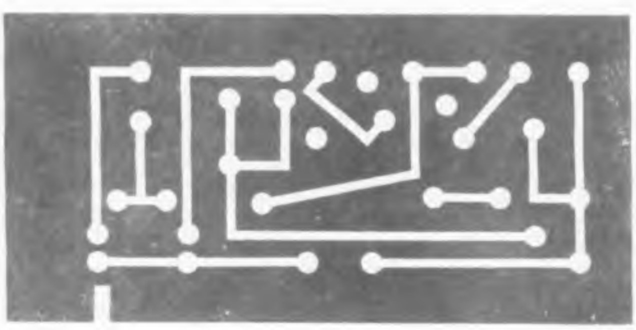
Model D4 regulated power supply provides two completely independent outputs, each continuously variable from 0 to 300 v. with

0.[illegible] regulation at loads from 0 to 200 ma. At the user's wish, the two outputs may be paralleled to double the output current or seriesed to double the output voltage. Also featured are two continuously variable bias supplies of 0 to -150 volts dc stabilized. Ripple of all the outputs is less than 10 mv. Separate meters monitor output voltage and current of each supply. **Oregon Electronic Mfg. Co., 2232 East Burnside St., Portland 15, Ore.**—TELE-TECH

Glide Path Test Set

Model AEC-170 glide path receiver test set is a battery operated portable oscillator which provides a crystal controlled signal at

332.6, 333.8 or 335 MC. If desired, 30% modulation from internal source at 90, 150 or 1000 CPS is available for glide path channels GX, GY and GZ. Suitable for operation in or out of cockpit up to 50 ft. from receiver antenna, attenuator output is 50,000 μv maximum, 100 μv minimum. Power is supplied by two 45-v. B batteries and two 6-v. A batteries. Twenty pound instrument measures 9 x 12.25 x 6.75 in. Total price FOB factory is $321.00. Company is also producing TS 67-C-1 U.S. signal generators, power supplies, radio transmitters, mobile receivers, and VHF antennas. **American Electroneering Corp., 5025-29 W. Jefferson Blvd., Los Angeles 16, Cal.**—TELE-TECH



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No Wires!

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Please send me information on Synthane laminated plastics and its use in "printed" circuits.

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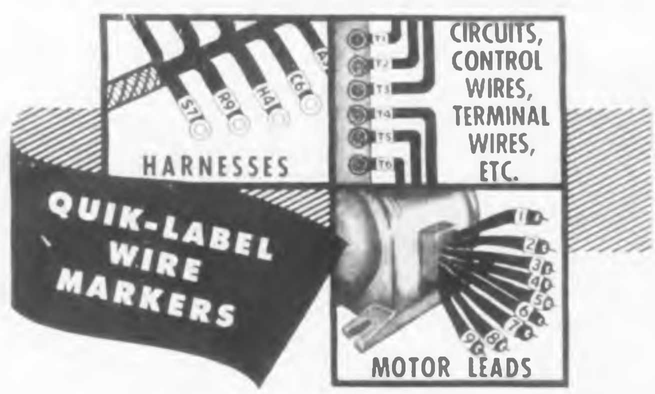

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STATION & STUDIO EQUIPMENT

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TV—FM—AM MICROWAVE——CIVILIAN MILITARY

Making available to all users and potential users of station and broadcast equipment, a complete listing of every manufacturer of communications equipment in whose products they are likely to be interested.

Designed also as a compilation of "end products," this Equipment Directory includes listings of all major replacement parts for communication equipment. Manufacturers who build and design government and military equipment are also presented.

FOR ALPHABETICAL LIST OF MANUFACTURERS SEE PAGE 119

PRODUCT INDEX OF MANUFACTURERS

Product	Section No.	Code Letter
Accessories, antenna	3	CE
audio	15	PA
cable	25	ZA
color, miscl.	10	KH
lighting	13	NA
microwave	7	GD
remote, PU, video	16	QA
video	12	MA
Adapters		
color, field sequential	10	KA
color, line & dot sequential	10	KB
Alarms, auto	4	DC
Altimeters, radio	3	CQ
Ammeters, antenna	28	CCA
Amplifiers, control	15	PAH
cueing	15	PB
distribution	12	MB
limiting	15	PC
line	15	PD
mixing	15	PE
monitoring	15	PF
montage	12	MS
noise suppressing	15	PG
program	15	PH
recording, audio	15	PI
recording, disc	18	SL
recording, tape	20	UF
remote, audio	15	PJ
remote PU, audio	17	RA
special	27	BBA
stabilizing	12	MC
Analyzers, spectrum	27	BBB
Antennas, aviation	3	CD
dummy	6	FD
microwave	7	GA
microwave	8	HA
police, etc.	4	DA
remote pickup	2	BA
remote pickup, video	16	QB
TV receiver	9	JA
UHF	7	GB
Apparatus, optical	14	ON
recording, kinescope	14	OL
Arms, pickup	18	SH
Attenuators, AF	27	BBC
audio	15	PK
control, broadcasting	1	AC
logarithmic	27	BBE
RF	27	BBD
video	12	MD
Baffles & Forms, spec. audio	26	AAG
Bases, antenna	4	DB
turntable	18	SR
Batteries, dry	31	FFA
dry, portable	31	FFB
hearing aid type	31	FFC
nickel-alkaline	31	FFD
storage, fixed	31	FFE
storage, portable	31	FFF
Books & Data Services		
manuals, engineering	34	JJA
manuals, test equipment	34	JJB
manuals, tube	34	JJC
manuals, TV maintenance	34	JJD
reference, condensed	34	JJE
reports & digests, FCC	34	JJF
Boxes, decade resistance	27	BBF
junction	25	ZH
Breakers, circuit, magnetic	29	DDK
Bridges, capacity	27	BBG
impedance	27	BBH
resistance	27	BBI
Cabinets	33	HHA
Cable	29	DDA
Cable, coaxial	25	ZD
shielded	25	ZN
Cameras	12	ME
Cameras, 16mm	14	OE
35mm	14	OD
field	10	KG
field	16	QF
film, TV	10	KK
film, TV	12	MAA
oscilloscope recording	27	BBJ
studio	10	KJ
Capacitors, air	29	DDB
ceramic	29	DDC
electrolytic	29	DDD
mica	29	DDE
oil	29	DDF
paper	29	DDG
pressurized	29	DDH
tantalum	29	DDI
vacuum	29	DDJ
Changers, record	18	SJ
Chargers, battery	32	GGA
Clamps, tube	5	EU
Clocks & Chronometers	33	HHB
Connectors, cable	25	ZB
microphone	25	ZI
power	25	ZL
Consoles, control, audio	15	PL
control, broadcasting	1	AD
control, lighting	13	ND
control, remote pickup	2	BD
control, studio	15	PAF
control, video	12	MK
dubbing, audio	15	PM
fixture	33	HHC
remote switching, video	12	ML
sound effects, audio	15	PAD
Controls, camera	12	MF
camera	16	QC
camera, TV film	12	MAB
lighting, antenna	6	FU
master, video	12	MR
Converters, DC to AC	17	RD
field sequential, color	10	KF
rotary	32	GGB
vibrator	32	GGC
Cords, patch, cable	25	ZJ
video	12	MT
Couplings, waveguide	8	HJ
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Crystals, aviation	3	CF
broadcasting	1	AE
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tube germanium	5	EB
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Detector, vacuum leak	27	BBL
Devices, anti-static	23	XA
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meter repair	28	CCG
servo	24	YA
Dimmers	13	NE
Diodes, noise	27	BCL

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Centralized Control... with

"tailored" switching and monitoring

TC-4A Control Console combines Audio-Video Switching with Transmitter Control—makes it possible to centralize all operations at one position

Now you can do all (or any desired part) of your audio-video switching *right in your transmitter room . . .*

And you do not have to take a fixed group of units to do it. You can have whatever group of audio and video facilities you need to fit your particular requirements. Moreover, you can add further audio and video facilities as needed.

You get this economy and flexibility by building your equipment layout around the new TC-4A Control Console. The TC-4A is a two-section unit containing basic switching facilities for handling up to 8 audio and 8 video signals (remote or local). It can fade to black and "program-switch" network, remote, film, and local studio signals. Up to twelve signals can be monitored including transmitter operation.

To this two-section unit you can add as many console sections (for "on-air" monitor, preview monitor, individual camera monitors) as you need to take care of your individual requirements. In this way you can build up a "centralized" control position from which one man can (if necessary) perform all operations.

Moreover, you do all of this with standard RCA units exactly like those used by the largest stations and the networks. Thus, if you decide later to expand to a multiple studio layout you can very easily rearrange these same units for that type of setup.

Remember . . . in TV it's good business to buy the best to begin with.

The basic TC-4A (left-hand and center sections) with a master monitor (right-hand section) as normally used at the transmitter (i.e., no video origination at this location).

The same setup with a film camera control unit added (at the left) for programming of slides and films from the transmitter—or for small stations without "live" studios.

TC-4A Control Console (3rd and 4th units from left) combined with three monitor sections to provide complete station operating control from a position in the transmitter room. In this arrangement the first unit of the console (starting from the left) is the "live" camera control and monitor, the second is a film camera control, the third unit contains audio faders and audio and video switching, the fourth unit contains monitor switching and remotely located equipment controls, the fifth unit is the line master monitor. Audio and video amplifiers, power supplies, etc., are mounted on the racks at left (shown shaded). The transmitter in the background is the Type TT-2A 2 kw, VHF TV Transmitter. However, the same arrangement of controls and audio-video facilities can, of course, be used with any RCA TV transmitter, UHF or VHF, 500 watts to 50,000 watts (providing ERP's of 1 kw to 1000 kw).

TC-4A with master monitor unit, preview monitor unit and two camera control units (one live and one film or two film). If desired, sections can be arranged U-shape or L-shape to fit available space.

Similar setup with two camera control units (one live and one film, or two film), such as used in the RCA "Basic Buy" for TV.

RCA

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DEPARTMENT CAMDEN, N.J.

PRODUCT INDEX (Continued)

Product	Section No.	Code Letter
Diplexers	6	FC
Discs	23	XC
Dollies, camera	12	MH
remote pickup, video	16	QE
Drives, electric	22	WA
Drives, flexible, auto	22	WB
spring	22	WC
Earphones	15	PN
Earphones	26	AAB
Equalizers, audio	15	PO
Equipment, antenna, custom	6	FB
broadcasting, auxiliary	1	AA
communication, Gov't.	35	KKA
control	4	DE
control, color	10	KE
distribution & mixing, video	12	MM
emergency, aviation	3	CG
facsimile	22	WD
fire detection & fighting	33	HHE
lighting, antenna	6	FA
loran, Gov't.	35	KKD
measuring, phase	6	FH
microwave, auxiliary	7	GC
microwave, auxiliary	8	HB
microwave, complete pkg	8	HC
microwave, remote pickup	2	BF
motion picture, animation	14	OA
auto rewinds	14	OB
editing	14	OH
printing	14	OO
processing	14	OP
rental	30	EEP
special effects	14	OV
splicing	14	OW
titling	14	OY
navigation, aero, Gov't.	35	KKB
navigation, airborne	3	CK
navigation, ground	3	CL
navigation, marine, Gov't	35	KKC
radar, Gov't	35	KKF
radiosonde, Gov't.	35	KKG
raydist, Gov't.	35	KKH
record mfg.	18	SK
remote mixing	17	RE
remote mixing, auxiliary	2	BB
shielding, audio	26	AAE
shoran, Gov't.	35	KKK
sofar, Gov't.	35	KKL
sonar, Gov't.	35	KKM
sound treatment	26	AAF
special effects, video	12	MW
storage, film	14	OK
storecasting	1	AG
switching, antenna	6	FO
synchronized, disc	18	SP
synchronized, film & tape	19	TO
synchronized, tape	20	UI
synchronized, wire	21	VE
special, tape	20	UH
telemetering	24	YB
teletype	22	WG
test, aviation	3	CR
test, custom design	27	BBK
test, microwave	8	HF
theatre, TV	30	EEE
transit radio	1	AH
Erasers, tape	23	XL
Fasteners	36	LLA
Film	23	XD
Film, raw stock	14	OI
Film, magnetic stripe	23	XE
Filters, equalizing	15	PP
Filters, RF interference	29	DDM
Filters, vestigial sideboard	6	FS
Fixtures, custom work	33	HHD
Fuses	36	LLB
Galvanometers	28	CCB
Gaskets	36	LLC
Generators, AM	27	BBM
color signal	10	KC
composite TV signal	27	BBP
FM	27	BBN
grating	27	BBQ
microwave signal	27	BBR
noise	27	BBS
pulse	27	BBT
signal	27	BBU
square wave	27	BBV
sweep	27	BBW
sync	12	MX
sync	16	QK
timing marker	27	BBX
TV	27	BBO
Gobos	13	NH
Heads, recording, disc	18	SM
tape	20	UG
wire	21	VD
Heads, reproducing, disc	18	SO
Iconoscopes	5	EG
Indexer, tape	20	UJ
Indicators, resonance	27	BBZ
volume	28	CCJ
Inductances, filter	29	DDN
tuning	29	DDO
Instruments, special lab.	27	BCA
thermocouple	28	CCI
Insulators	6	FF
Irons, soldering	36	LLE
Jacks, telephone & micro-		

Product	Section No.	Code Letter
phone	25	ZG
Kinescoping	30	EEF
Kits, portable lighting	13	NL
Labs., film processing	30	EEG
Lathes	18	SD
Lenses	12	MP
Lenses	14	OM
Lenses	16	QG
Libraries, record	30	EEH
Libraries, tape music	30	EEI
Lighting, fluorescent	13	NF
incandescent	13	NI
Lights, arc	13	NB
black	13	NC
Lines, delay	29	DEF
slotted	8	HE
transmission	8	HH
transmission, dehydrator	6	FT
transmission, waveguide	6	FR
Loudspeakers	26	AAD
HiFi	26	AAC
Markers, cable	25	ZC
cue	14	OG
Materials, special effects	30	EEJ
Mechanisms, cutting	18	SC
tape	20	UA
Meters, ampere	28	CCC
crystal impedance	27	BCC
distortion & noise	27	BCD
frequency	27	BCE
frequency	28	CCD
grid dip	27	BCF
light	13	NJ
output power	27	BCG
phase	27	BDA
power level	27	BDC
Q	27	BCB
RF power	28	CCE
sound level	27	BCH
standing wave ratio	6	FN
vibration	27	BCI
volt	28	CCF
wow & flutter	27	BCJ
Microphones, carbon	15	PS
condenser	15	PT
crystal	15	PU
dynamic	15	PV
miscl	4	DI
miscl	15	PW
velocity	15	PX
Microscopes	18	SE
Microvolter, audio frequency	27	BCK
Monitors, antenna phase	11	LA
audio	11	LB
frequency	11	LC
line & program	12	MQ
modulation	11	LD
RF power	6	FL
service	11	LE
video line	11	LF
video off-the-air	11	LG
waveform	11	LH
Motors	18	SF
Mountings, vibration	2	BL
vibration	3	CT
vibration	4	DS
Nameplates, microphone	15	PY
Needles, cutting	23	XB
playback	23	XI
reproducing	23	XJ
Optics, military	35	KKE
Oscillators, audio	27	BCM
UHF	27	BCN
Oscilloscopes	27	BCO
Packing, transportation	33	HHJ
Panels, jack	15	PR
jack	25	ZF
lighting preset	13	NK
video patch	12	MAI
Paper rolls	23	XH
Pigments, fluorescent	13	NG
Players, transcription	18	SQ
Plugs	25	ZK
Pre-Amplifiers	15	PAB
Probes, crystal	5	ED
Projectors, film, TV	12	MAC
kaleidoscope, TV	12	MAD
mirror multiplexers, TV	12	MAE
rear	14	OT
rear screen, TV	12	MAF
slide, TV	12	MAG
special purpose, TV	12	MAH
theatre, TV	14	OX
16 mm.	14	OR
35 mm	14	OS
Racks, equipment	33	HHG
Racks, storage, disc	33	HHF
Racks, storage, tape	33	HHH
Radar, aviation	3	CP
Gov't.	35	KKF
police	4	DN
Radiators, FM	6	FJ
TV	6	FK
Radios, citizens	4	DD
Radiosonde	35	KKG
Radomes	7	GF
Raydist	35	KKH
Readers, sound	14	OU
Receivers, aviation, fixed	9	JB
aviation, mobile	9	JC

Product	Section No.	Code Letter
broadcast, AM	9	JD
broadcast, FM	9	JE
broadcast, TV	9	JF
color, TV	10	KI
communication, AM	9	JG
communication, FM	9	JH
communication, Gov't.	35	KKI
cue	17	RC
fixed	4	DO
microwave	8	HD
microwave	16	QH
mobile	4	DP
remote pickup, civilian defense	9	JI
remote pickup, fixed	9	JJ
remote pickup, mobile	9	JK
remote pickup, spec. purpose	9	JL
studio link	7	GH
Recorders, controller, airport	3	CC
film	4	DG
airborne	3	CA
magnetic airborne	3	CB
magnetic stripe, portable, 8 mm	19	TA
16 mm	19	TC
17.5 mm	19	TG
35 mm	19	TE
magnetic stripe, studio, 8 mm	19	TB
16 mm	19	TD
17.5 mm	19	TH
35 mm	19	TF
photographic, portable, 8 mm	19	TI
16 mm	19	TK
35 mm	19	TM
photographic, studio 8 mm	19	TJ
16 mm	19	TL
35 mm	19	TN
fixed, graphic	22	WE
graphic	27	BBY
portable, graphic	22	WF
tape	20	UD
wire	21	VB
miniature, tape	20	UC
miniature, wire	21	VA
portable, complete, disc	18	SA
studio, complete, disc	18	SB
studio, tape	20	UE
wire	21	VC
Records, frequency test	27	BCP
sound effects	30	EED
Rectifiers, metal	29	DDP
metallic	5	EM
Reels, cable	25	ZM
Reels & Cans, film	23	XG
Reels, continuous projection	14	OF
Reels & flanges, tape	23	XM
Regulators, 60 cps	32	GGD
400 cps	32	GGE
voltage	5	ET
Relays, antenna	29	DDQ
audio control	29	DDR
power	29	DDS
time delay	29	DEI
video control	29	DDT
Research, Gov't.	35	KKJ
Resistors, power type	29	DDU
variable	29	DDV
Rigging, studio	13	NN
Rooms, screen	33	HHI
Rotators, antenna	6	FM
Scanners, flying spot	12	MO
Scrapers, film	14	OJ
Screens, background	14	OC
Screens, projection	14	OQ
Services, construction	30	EEA
design, special audio	30	EEB
dubbing, sound	30	EEC
effects, record, sound	30	EED
equipment, theatre, TV	30	EEE
film editing, titling, etc.	30	EER
frequency measuring	30	EES
news	30	EET
production, film	30	EEK
production, film, TV spot	30	EEM
production, slides	30	EEL
production, transcriptions	30	EEN
program	30	EEU
property & scenery, TV	30	EEO
rental, TV film	30	EEQ
services & repairs, spec. optical & motion picture	30	EEV
Sets, generator, engine driven	32	GGF
measuring, field strength	27	BCQ
measuring, sound level	27	BCS
measuring, transmission	27	BCT
pack	4	DJ
test, insulation	27	BCR
Shoran	35	KKK
Sofar	35	KKL
Solder	36	LLD
Sonar	35	KKM
Splicers, tape	23	XN
Splicetools	36	LLF
Stages, sound	30	EEW
Standards, frequency	27	BCU
Stands & Booms, Microphone	15	PZ

Product	Section No.	Code Letter
Stretchers, sync.	12	MY
Stroboscope	27	BCV
Studios, film	30	EEX
Supplies, power, auxiliary:		
broadcast	1	AB
remote pickup, audio	17	RB
remote pickup	2	BC
Supplies, power, emergency:		
aviation	3	CN
police	4	DM
Supplies, power, AC, DC	32	GGG
audio	15	PAA
aviation	3	CM
broadcast	1	AF
government	35	KKN
lighting	13	NM
police	4	DL
regulated	32	GGH
remote pickup	2	BG
remote pickup, video	16	QJ
special purpose	32	GGI
tape	20	UB
variable frequency	32	GGJ
video	12	MU
400 CPS	3	CO
Supplies, miscl., recording	23	XF
Switches, coaxial	25	ZE
lever	29	DDW
mercury	29	DDX
power	29	DDY
rotary	29	DDZ
time delay	29	DEA
vacuum	29	DEH
Systems, cueing, radio	15	PAC
distribution, TV, RF.	12	MN
ground	6	FE
intercommunication	3	CH
intercommunication	4	DH
intercommunication	15	PQ
landing, airborne	3	CI
landing, ground	3	CJ
reinforcement, sound	15	PAE
switching	15	PAG
switching, camera	12	MI
switching, camera	16	QD
Tape	23	XK
Telemetering equipment	24	YB
Telephones, field, portable	4	DK
Terminals	25	ZO
Testers, tube	27	BCW
Tools, minor repair	36	LIG
Towers, AM	6	FP
Towers, microwave	8	HG
Towers, supporting	6	FQ
Tranceivers	4	DQ
Transformers, audio	29	DEB
flyback	29	DEG
power	29	DEC
pulse	29	DED
Transmitters, audio	17	RF
audio, microwave	16	QI
AM, broadcast	1	AI
FM, broadcast	1	AJ
TV, broadcast	1	AK
aviation	3	CS
government	35	KKO
HF broadcast, Gov't.	35	KKP
microwave	8	HI
police	4	DR
remote pickup, AM	2	BH
remote pickup, FM	2	BI
remote pickup, TV	2	BJ
STL	7	GI
Tripods	12	MZ
Tripods	16	QL
Trucks, remote pickup	2	BK
Tubes, cathode ray	5	EA
color	10	KD
image orthicon	5	EH
klystron	5	E
magnetron	5	EI
photo	5	EK
receiving	5	E
rectifier	5	EN
special type	5	EO
subminiature	5	EP
thyratron	5	EQ
transistors	5	E
transmitting	5	E
Tuners, TV	9	JA
Turntables, multispeed	18	SC
recording	18	SN
Turrets, camera	12	M
Tweeters	26	AA
Units, base	26	AA
decade inductor	27	BC
isolation	6	F
microwave, complete relay	7	G
phasing & tuning	6	F
playback	18	[illegible]
projection	12	M
Viewfinders	14	O
Voltmeters, vacuum tube	27	BC
Volt-ohm-millammeters	27	BC
Walkie-Talkies	4	D
Waveguides	16	Q
flexible	8	H
rigid	8	H
Wire	23	XC
Yokes, deflection	29	DD

Alphabetical INDEX of MANUFACTURERS

(Numbers indicate sections of Directory where products are listed)

Because of lack of space, it has been found impossible to show below *all* the products of some of the manufacturers listed, beyond four or five representative product classifications. These representative products, by numbers, are given to enable readers to locate manufacturers addresses. The main Directory, however, under all its various product classifications taken together, does present the complete lines of each manufacturer as reported by him to the publishers.

TELE-TECH • 1953 Station & Studio Equipment Directory • Copyright, Caldwell-Clements, Inc., 1952

MANUFACTURERS INDEX (Continued)

TYPE 315 5000 WATT TRANSMITTER

The CONTINENTAL Type 315 Transmitter, at left, offers a deluxe design for 5 KW AM operation. It has many features not ordinarily incorporated in transmitters of this class, including special equipment for matching transmitter output into sharply tuned loads often encountered in directional arrays.

The Phasing Control and Power Division Unit, at right, is custom designed to fulfill individual station requirements. It is housed in a new style, unified, all aluminum cabinet, and is designed to be a companion unit to any of the CONTINENTAL transmitters.

PHASING CONTROL AND POWER DIVISION UNIT

FOR BROADCASTING EQUIPMENT ABOVE AND BEYOND THE USUAL STANDARDS

Continental

IS THE NAME TO REMEMBER

A recent addition to the CONTINENTAL line is the Type 314-2 1 KW AM Transmitter, at left. Simplicity of design and operation has been achieved without sacrifice of refinement features found in larger equipments. All aluminum cabinet of special, unified, frameless design incorporates Transview styling with functional features affording maximum accessibility, shielding, and circulation of air for cooling.

Latest CONTINENTAL creation is the new Type 312 250-Watt Transmitter, at right, which combines exceptionally fine performance with extreme simplicity. It has the same style of cabinet as the Type 314-2 with attendant features.

Distributed in U.S.A. by

GRAYBAR ELECTRIC COMPANY

Offices in Over 100 Principal Cities

★

Export Agent

HENRY J. GEIST & ASSOCIATES, Inc.

60 E. 42nd St., New York 17, N. Y.

TYPE 314-2
1000 WATT TRANSMITTER

TYPE 312
250 WATT TRANSMITTER

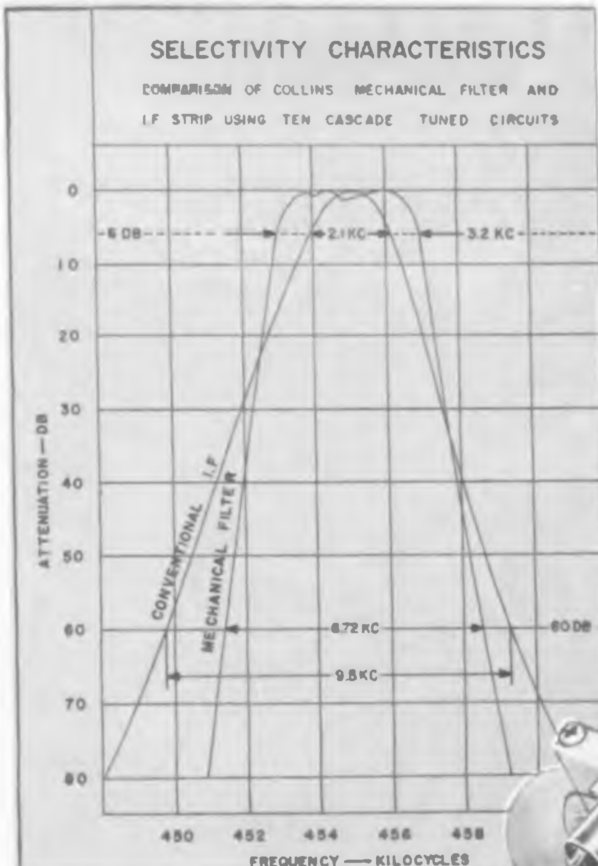
Continental Electronics

MANUFACTURING COMPANY

DALLAS 10, TEXAS

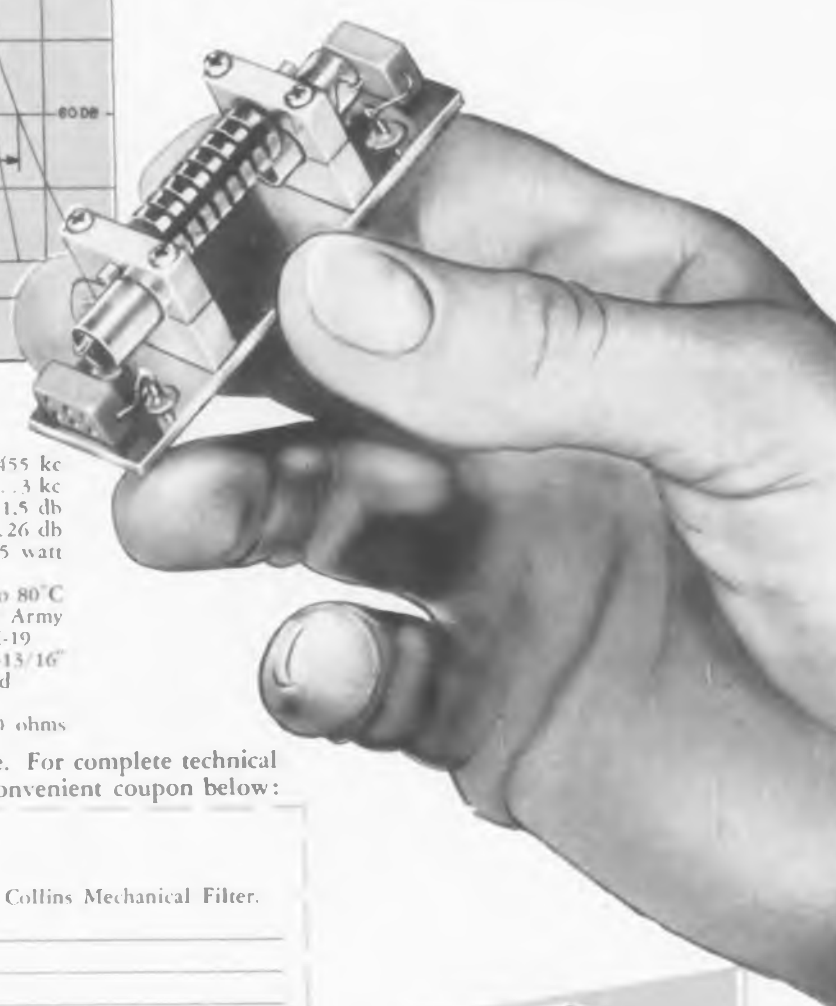
MANUFACTURERS INDEX (Continued)

The *NEW* Collins Mechanical Filter . . .



ANOTHER outstanding result of Collins Research and Development — the Mechanical Filter — has been engineered to fill a long-standing need in the field of electronics for a compact, permanently tuned band pass filter for intermediate frequency amplifier applications. Mechanical elements of the Collins Filter provide selectivity characteristics approximating the ideal rectangular shape needed for very close spacing of adjacent voice communication channels. Space requirements are reduced to a minimum with this hermetically sealed component that *requires no adjustment.*

Production of the Collins Mechanical Filter in quantity is going ahead at an increased rate in anticipation of the many applications in industry for which this NEW Filter will be found ideally suited. Characteristics of Filters in current production are shown in the specifications below. Filters having other characteristics are in development and will be announced in the future.



SPECIFICATIONS

Operating Frequency .... 455 kc
Nominal Band Width .... 3 kc
Peak to Valley Ratio .... 1.5 db
Insertion Loss .... 26 db
Overload Input Power Level .... .035 watt
Operating Temperature Range (without temperature compensation) .... 15°C to 80°C
Vibration .... Satisfies Requirements of Army Navy Specification AN-E-19
Case Size .... 1" x 15/16" x 2-13/16"
(Filter Shown with Hermetically Sealed Shield Removed)
Input and Output Impedance .... 6,500 ohms

Engineering samples are now available. For complete technical data and price information, use the convenient coupon below:

Collins Radio Company (Dept. 21)
Cedar Rapids, Iowa

Please send complete Information on The Collins Mechanical Filter.

NAME ____________________

TITLE ____________________

ADDRESS OR FIRM ____________________

CITY ____________________ STATE ____________________

For advanced electronic development, it's . . . COLLINS

COLLINS RADIO COMPANY, Cedar Rapids, Iowa

11 W. 42nd Street, NEW YORK 36 · 1930 Hi-Line Drive, DALLAS 2 · 2700 W. Olive Avenue, BURBANK

"9,000 HOURS FROM 2 G-E TUBES SAVED WJBK-TV $1,140!"

Says **Paul Frincke, Engineer of Detroit's successful Temple Avenue station owned and operated by Storer Broadcasting Co.**

"We have a pair of GL-9C24's in our transmitter that show over twice the normal life for final-stage power tubes. They represent a saving—at current prices—of $1,140 for two replacement tubes we *haven't* had to buy!

"Right through the list—power tubes, rectifiers, and receiving types—G-E tubes are paying their way at WJBK-TV, and adding dividends in extra hours of life. Another gain is the fast tube service which local General Electric distribution gives us on a 24-hour basis. It's real on-the-air insurance to back up our spares. Put us down as 100-per-cent satisfied!"

* * *

That's mighty fine to hear, Mr. Frincke, particularly from the experienced engineer of a busy metropolitan station! General Electric distributors offer the same economy tube operation—the same alert and speedy service—to all AM, FM, and TV stations from coast to coast.

Phone *your* G-E tube distributor today! He has on hand the tubes you need, is anxious to serve you well in order to cement a business relationship that will profit you both through the years.

● WJBK-TV's loyal motor-city audience likes home-making hints, news, the drama, and sports. By telecasting such events as the Kentucky Derby and football games of the Detroit Lions, WJBK-TV lives up to its motto "First in Sports". High standards of transmission sustain picture quality. From the day the station went on the air, General Electric tubes have helped to keep performance up, costs down.

FREE TO STATION ENGINEERS!

"Essential Characteristics", a handy pocket guide to all receiving tubes in common use, is yours on request. Ask your G-E tube distributor for this reference booklet you'll use daily . . . hourly! Or write to *Section B, Tube Department, General Electric Co., Schenectady 5, N. Y.*

GENERAL ELECTRIC

161-1C1

TELE-TECH's
STATION & STUDIO EQUIPMENT
DIRECTORY

TV—FM—AM—MICROWAVE——CIVILIAN—MILITARY

PRODUCT INDEX ON PAGES 115, 118 IN THIS SECTION • ALPHABETICAL LIST OF MANUFACTURERS PAGES 119, 120, 122

TRANSMITTING EQUIPMENT

1—Broadcast

Auxiliary equipment .... **AA**
Auxiliary power supplies .... **AB**
Control Attenuators .... **AC**
Control consoles .... **AD**
Crystals .... **AE**
Power supplies .... **AF**
Storecasting equipment .... **AG**
Transit radio equipment .... **AH**
Transmitters, AM .... **AI**
Transmitters, FM .... **AJ**
Transmitters, TV .... **AK**

Accurate Eng'g Co., 2005 Blue Island Ave., Chicago 8, Ill.—AB, AF
Acorn Electronics, Gibson City, Ill.—AA, AF
Aero Electronics, 1512 N. Wells St., Chicago, 10, Ill.—AA
Altec-Lansing Corp., 9356 Santa Monica Blvd., Beverly Hills, Calif.—AD
American Electroneering, 5025 W. Jefferson Blvd., Los Angeles 16, Calif.—AF, AI
American Television & Radio, 300 E. 4th St., St. Paul, 1, Minn.—AB, AF
Ampex Electric Corp., 934 Charter St., Redwood City, Calif.—AA, AF
Amplifier Corp. of America, 398 Broadway, New York 13, N. Y.—AF
Audio & Video Prod. Corp., 730 Fifth Ave., New York 3, N. Y.—AD

Bassett Inc., Rex, 1314 N. E. 17 Court, Ft. Lauderdale, Fla.—AE
Beta Electric Corp., 333 E. 103rd St., New York 29, N. Y.—AF
Bliley Electric Co., Union St. Bldg., Erie Pa.—AE
Bogue Railway Equip. Div., 52 Iowa Ave., Paterson 5, N. J.—AB, AF
Bruno Laboratories, 1520 Evergreen Road, Williamsport 15, Pa.—AE
Bunnell & Co., J. H., 81 Prospect St., Brooklyn 1, N. Y.—AB, AF, AI, AJ
Burgess Battery Co., Freeport, Ill.—AF
Burnett Radio Lab., Wm. W. L., 4814 Idaho St., San Diego, Calif.—AB

Carter Motor Co., 2654 N. Maplewood Ave., Chicago 47, Ill.—AF
Centralab, 900 E. Keefe, Milwaukee 1, Wis.—AC
Chatham Electronics Corp., 475 Washington St., Newark 2, N. J.—AF
Cinema Eng'g Co., 1510 W. Verdugo Ave., Burbank, Calif.—AC, AD, AF
Collins Radio Co., 855 35th St. N.E., Cedar Rapids, Iowa—AA, AC, AD, AE, AF, AI, AJ
Commercial Radio Equip. Co., 1319 "F" St., Washington, D. C.—AE
Commercial Radio Monitoring Co., P. O. Box 7037, Kansas City, Mo.—AE
Communication Devices Co., 2331 12th Ave., New York 27, N. Y.—AF, AI, AJ
Continental Electronics Mfg. Co., 4213 S. Buckner Blvd., Dallas 10, Tex.—AI
Cornell-Dubilier Electric Corp., 333 Hamilton Blvd., S. Plainfield, N. J.—AB, AF
Crystal Research Labs., 29 Allyn St., Hartford, Conn.—AE
Cubic Corp., 2841 Canon St., San Diego 6, Calif.—AA, AB, AI, AJ

Daven Co., 193 Central Ave., Newark 4, N. J.—AC
Dittmore & Freimuth Co., 2517 E. Norwich St., Cudahy, Wis.—AB, AD, AF
Du Mont Labs., Inc., Allen B., 1500 Main Ave., Clifton, N. J.—AA, AB, AD, AF, AK
DX Radio Products Co., 2300 W. Armitage Ave., Chicago 47, Ill.—AE

Eidson Electronic Co., 1802 N. Third St., Temple, Tex.—AE
Eltron, 407 N. Jackson St., Jackson, Mich.—AB
Electronic Development Lab., 43-07 23 Ave., Long Island City 5, N. Y.—AA, AB, AD, AF, AG
Electron-Radar Prod., Inc., 1041 N. Pulaski Rd., Chicago 51, Ill.—AC
Electro Products Labs., 4501 N. Ravenswood Ave., Chicago 40, Ill.—AF
Elex Co., 69 19 215 St., Bayside, N. Y.—AF
Equipment & Service Co., 6815 Oriole Dr., Dallas 9, Tex.—AA, AB, AC, AD, AE, AF

Federal Telecommunication Labs., 500 Washington Ave., Nutley 10, N. J.—AA, AD, AK
Ferranti Electric, Inc., 30 Rockefeller Plaza, New York 20, N. Y.—AB, AF
Fluke Eng'g Co., Box 755, Springdale, Conn.—AF
Furst Electronics, 3322 W. Lawrence Ave., Chicago 25, Ill.—AF

Gates Radio Co., 123 Hampshire St., Quincy 1, Ill.—AA, AB, AC, AD, AE, AF, AI, AJ, AK
General Electric Co., Electronics Div., Electronics Park, Syracuse, N. Y.—AD, AE, AF, AK
General Electrosonics, Inc., 32 W. 22nd St., New York 10, N. Y.—AF
Georator Corp., 1820 N. Nash, Arlington 9, Va.—AF
Gelton Mfg., 212 Durham Ave., Metuchen, N. J.—AE

Harvey-Wells Electronics, North St., Southbridge, Mass.—AF, AH
Heyman Mfg. Co., 300 Michigan Ave., Kenilworth, N. J.—AE
Highland Eng'g Co., Main & Urban, Westbury, N. Y.—AF
Hunt Corp., 453 Lincoln St., Carlisle, Pa.—AE

INET, Inc., 8655 S. Main St., Los Angeles 3, Calif.—AB, AD, AF
International Research Assoc., 2221 Warwick Ave., Santa Monica, Calif.—AB, AF, AK

Johnson Co., E. F., Waseca, Minn.—AA

Kepco Labs., Inc., 131 38 Sanford Ave., Flushing 55, N. Y.—AB, AF
Knights Co., James, Sandwich, Ill.—AE

Lambda Electronics Corp., 103-02 Northern Blvd., Corona 68, N. Y.—AF
Langevin Mfg. Corp., 37 W. 65th St., New York 23, N. Y.—AB, AD, AF, AG, AH
Lee Electric & Mfg. Co., 2806 Clearwater St., Los Angeles 39, Calif.—AF
Lowell Mfg. Co., 1531 Branch St., St. Louis 7, Mo.—AG, AH

Mercury Electronic Co., Box 450, Red Bank, N. J.—AF
Midco Mfg. Co., 607 N. 8th, Sheboygan, Wis.—AF
Millen Mfg. Co., James, 150 Exchange St., Malden 48, Mass.—AF
Model Rectifier Corp., 557 Rogers Ave., Brooklyn 25, N. Y.—AB, AF
Modulation Products Co., 56 Lispenard St., New York 13, N. Y.—AE

Nebel Lab., 1101 Lincoln Pl., B'klyn 13, N. Y.—AE
Neptune Electronics Co., 433 Broadway, New York 13, N. Y.—AD, AF
Neutronic Assoc., 81-56 Victor Ave., Elmhurst 73, N. Y.—AF
North Electric Mfg. Co., 501 S. Market St., Galion, Ohio—AD

O'Brien Electric Co., 6511 Santa Monica Blvd., Hollywood 38, Calif.—AA, AD
Opad-Green Co., 71 Warren St., New York 7, N. Y.—AB, AF

Pedersen Electronics, Box 572, Lafayette, Calif.—AF
Piezo Prods. Co., Framingham, Mass.—AE
Precision Piezo Service, 427 Mayflower St., Baton Rouge 10, La.—AE
Precision Products, Inc., 719 17th St., N.W., Washington, D. C.—AE

Radio Corp. of America, RCA Victor Div., Camden, N. J.—AA, AB, AD, AE, AF, AI, AJ, AK
Radio Eng'g Labs., Inc., 36-40 37th St., Long Island City 1, N. Y.—AG, AH, AJ
Radio Labs., Inc., 1846 Westlake North, Seattle 9, Wash.—AI, AJ
Radio Sonic Corp., 186 Union Ave., New Rochelle, N. Y.—AF
Radio Specialty Mfg. Co., 2023 S. E. 6th Ave., Portland 14, Ore.—AE
Reeves-Hoffman Corp., 145 Cherry, Carlisle, Pa.—AE

Sealtron Co., The, 9701 Reading Road, Cincinnati 15, Ohio—AF
Shallcross Mfg. Co., Pusey & Jackson Aves., Collingdale, Pa.—AC
Sierra Electronic Corp., 1050 Brittan Ave., San Carlos, Calif.—AB, AF, AI, AJ
Sonar Radio Corp., 59 Myrtle, B'klyn 1, N. Y.—AF
Sorensen & Co., 375 Fairfield Ave., Stamford, Conn.—AF
Sound Sales & Eng'g Co., 2005 La Branch, Houston 3, Tex.—AA, AD, AG
Spencer-Kennedy Labs., Inc., 186 Massachusetts Ave., Cambridge 39, Mass.—AA
Standard Crystal Co., 400 Armstrong Ave., Kansas City 1, Kans.—AE
Standard Electronics Corp., 285 Emmet St., Newark 5, N. J.—AA, AB, AD, AF, AI, AJ, AK
Standard Piezo Co., 265 Pomfret, Carlisle, Pa.—AE
Stelma, Inc., 188 Ludlow St., Stamford, Conn.—AF

Taflet Radio & TV Co., 2330 Belmont Ave., New York 58, N. Y.—AH
Tech Labs., Inc., Bergen & Edsal Blvd., Palisades Park, N. J.—AC
Tedford Crystal Labs., 4126 Colerain Ave., Cincinnati 23, Ohio—AE
Telechrome, Inc., 88 Merrick Rd., Amityville, L. I., N. Y.—AA, AB, AD, AK
Telemarine Communications Co., 536-542 W. 27th St., New York 1, N. Y.—AJ
Todd-Tran Corp., 752 S. Third Ave., Mt. Vernon, N. Y.—AB, AF
Transformer Technicians, Inc., 2608 N. Cicero Ave., Chicago 39, Ill.—AF
Transmitter Equip. Mfg. Co., 345 Hudson St., New York 14, N. Y.—AA, AB, AD, AF, AG, AI
Tri-Dex Co., P. O. Box 1207, Lindsay, Calif.—AF

U. S. Motors Corp., 581 Nebraska, Oshkosh, Wis.—AB
United Transformer Co., 150 Varick St., New York 13, N. Y.—AC
Universal Aviation Corp., 230 Park Ave., New York, N. Y.—AD
Universal Electronics Co., 2012 S. Sepulveda Blvd., Los Angeles 25, Calif.—AF
Utility Electronics Corp., 231 Grant Ave., E. Newark, N. J.—AI, AJ

Valpey Crystal Corp., P. O. Box 325, Holliston, Mass.—AE
Vokar Corp., 7300 Huron R. Dr., Dexter, Mich.—AF

Westinghouse Electric Corp., 2519 Wilkens Ave., Baltimore 3, Md.—AD, AI, AJ
Willard Storage Battery Co., 246 E. 131st St., Cleveland 1, Ohio—AB
Wincharger Corp., E. 7th at Division, Sioux City 2, Iowa—AB

THIS DIRECTORY

of station and studio equipment, showing products available to broadcasters and communications companies, is intended as a reference and guide for TV-radio-electronic engineers throughout the entire Western hemisphere.

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Television Station WTTG
Phone: STerling 5300

BALTIMORE
1551 Pentwood Road
Phone: TUxedo 6689

LOS ANGELES
1136 North Las Palmas
Phone: GRanite 1185

CHICAGO
919 North Michigan Boulevard
Room 1616
Phone: Michigan 2-0354

DALLAS
1531 Turtle Creek Blvd.
Phone: PRospect 6220

ATLANTA-CHARLOTTE
2101 Arnold Drive
Charlotte, N. C.
Phone: CHarlotte 5-6519

2—*Remote Pickup*

Accurate Eng'g, 2005 Blue Island Ave., Chicago 8, Ill.—BC, BG
Acorn Electronics, Box 348, Gibson City, Ill.—BG
Aero Electronics, 1512 N. Wells St., Chicago 10, Ill.—BB, BF, BG
Ainslie Electronic Prods., 312 Quincy Ave., Quincy 69, Mass.—BA
Alpar Mfg. Co., 466 St. Francis St., Redwood City, Calif.—BA
Altec Lansing Corp., 9356 Santa Monica Blvd., Beverly Hills, Calif.—BD
American Electroneering, 5025 W. Jefferson Blvd., Los Angeles 16, Calif.—BG, BH
American Television & Radio, 300 E. 4th St., St. Paul, Minn.—BC
Andrew Corp., 363 E. 75th, Chicago 20, Ill.—BA
ARF Products, 7627 Lake, River Forest, Ill.—BF
Audio & Video Prods., 730 Fifth Ave., New York 3, N. Y.—BD

Bardwell & McAlister, 2950 N. Ontario St., Burbank, Calif.—BA, BG
Barry Corp., 700 Pleasant, Watertown 72, Mass.—BL
Bassett, Inc., Rex, 1314 N. E. 17 Court, Ft. Lauderdale, Fla.—BE
Beta Electric Corp., 333 E. 103rd St., New York 29, N. Y.—BG
Bogue Railway Equip. Div., 52 Iowa Ave., Paterson 5, N. J.—BG
Budelman Radio, 375 Fairfield Ave., Stamford, Conn.—BA, BB, BC, BE, BF, BG, BH, BI
Burgess Battery, Freeport, Ill.—BG

Camburn, Inc., 32-40 57th, Woodside 77, N. Y.—BA
Camfield Mfg., 7th St., Grand Haven, Mich.—BA
Capehart-Farnsworth, Ft. Wayne, Ind.—BF
Carter Motor Co., 2654 N. Maplewood Ave., Chicago 47, Ill.—BG
C.G.S. Labs., 391 Ludlow St., Stamford, Conn.—BF

REMOTE PICKUP

- 450 Mc Handheld FM Transmitter (Illustrated)
- 450 Mc Mobile & Portable FM Transmitters
- 450 Mc FM Receivers
- 26 Mc Cue Transmitters
- 26 Mc Pocket Size Cue Receivers
- Frequency Deviation Meters

We specialize in Remote Pickup Broadcast Radio Equipment to the latest FCC requirements. The most modern designs on the market with years of engineering experience in this specialized field are offered. Let us suggest the solution to your Remote Pickup problem and quote on your requirements. Write for Descriptive Specifications on the standard designs listed above.

BUDELMAN RADIO
CORPORATION
375 FAIRFIELD AVE., STAMFORD, CONN.

Cinema Eng'g., 1510 W. Verdugo, Burbank, Calif.—BD
Commercial Radio Monitoring, Box 7037, Kansas City, Mo.—BE
Communication Devices, 2331 12th Ave., New York 27, N. Y.—BB, BH, BI
Communication Prods., Marlboro, N. J.—BA
Cornell-Dubilier Elec., 333 Hamilton Blvd., S. Plainfield, N. J.—BA., BC, BG
Crystal Research Labs., 29 Allyn, Hartford, Conn.—BE
Cubic Corp., 2841 Canon St., San Diego 6, Calif.—BA, BB, BC, BF, BH, BI

Danbury-Knudsen, Inc., Danbury, Conn.—BF
Dittmore & Freimuth Co., 2517 E. Norwich St., Cudahy, Wisc.—BA, BC, BD, BG
Doolittle Radio, 7421 S. Loomis Blvd., Chicago 36, Ill.—BI
Dorne & Margolin, Sheridan Ave., Bethpage, L. I., N. Y.—BA
Du Mont Labs., Allen B., 1500 Main Ave., Clifton, N. J.—BA, BB, BC, BD, BF, BG, BJ, BK

Eidson Electronic, 1802 N. Third St., Temple, Tex.—BE
Electronic Development Lab., 43-07 23rd Ave., Long Island City 5, N. Y.—BB, BC, BD, BG, BK
Electronic Research & Mfg., 1420 E. 25th St., Cleveland 14, Ohio—BB, BI
Electron-Radar Prods., 1041 N. Pulaski Rd., Chicago 51, Ill.—BA, BF
Engineering Associates, 434 Patterson Rd., Dayton 9, Ohio—BF
Equipment & Service, 6815 Oriole Drive, Dallas 9, Tex.—BB, BC, BD, BE, BG

Federal Telecommunication Labs., 500 Washington Ave., Nutley 10, N. J.—BA, BF, BJ, BK
Ferranti Electric, 30 Rockefeller Plaza, New York 20, N. Y.—BC, BG
Fluke Eng'g Co., Box 755, Springdale, Conn.—BG
Furst Electronics, 3322 W. Lawrence Ave., Chicago 25, Ill.—BG

Gadgets, Inc., 3629 N. Dixie, Dayton 5, Ohio—BA
Gates Radio, 123 Hampshire St., Quincy 1, Ill.—BD, BE, BH, BI, BJ
General Electric Co., Electronics Div., Electronics Park, Syracuse, N. Y.—BA, BD, BE, BF, BJ, BK
General Electrosonics, 32 W. 22nd St., New York 10, N. Y.—BG
Georator Corp., 1820 N. Nash, Arlington 9, Va.—BG
Gulton Mfg., 212 Durham Ave., Metuchen, N. J.—BE
G. W. Assoc., Box 2263, El Segundo, Calif.—BA, BF

Hamilton Kent Mfg., Kent, Ohio—BL
Harvey-Wells Electronics, Southbridge, Mass.—BH
Hewlett-Packard Co., Palo Alto, Calif.—BF
Heyman Mfg., 300 Michigan Ave., Kenilworth, N. J.—BE
Highland Eng'g Co., Main & Urban, Westbury, N. Y.—BG
Hughey & Phillips, 4075 Beverly Blvd., Los Angeles 4, Calif.—BF
Hunt Corp., 453 Lincoln St., Carlisle, Pa.—BE

Industrial Products Co., Danbury, Conn.—BF
INET, Inc., 8655 S. Main St., Los Angeles 3, Calif.—BC, BD, BG
Insuline Corp. of America, 36-02 35th Ave., Long Island City 1, N. Y.—BA, BL
International Research Associates, Div. of Iresco., Inc., 2221 Warwick Ave., Santa Monica, Calif.—BC, BF, BG, BJ

Kalbfell Labs., Box 1578, San Diego 10, Calif.—BI
Kepco Labs., 131-38 Sanford, Flushing 55, N. Y.—BC, BG
Kings Electronics, Inc., 50 Marbledale Ave., Tuckahoe, N. Y.—BI.
Kings Microwave Co., 50 Marbledale Ave., Tuckahoe, N. Y.—BA, BF
Knights Co., James, Sandwich, Ill.—BE

Lambda Electronics, 103-02 Northern Blvd., Corona 68, N. Y.—BG
Langevin Mfg., 37 W. 65th St., New York 23, N. Y.—BC, BD, BG
Lord Mfg., 1635 W. 12th St., Erie, Pa.—BL

Mark Prods., 3547-49 Montrose Ave., Chicago 18, Ill.—BA, BF
Microlab, 301 S. Ridgewood, S. Orange, N. J.—BF
Mideo Mfg., 607 N. 8th St., Sheboygan, Wisc.—BG
Millen Mfg., J., 150 Exchange, Malden 48, Mass.—BG
Model Rectifier Corp., 557 Rogers Ave., Brooklyn 25, N. Y.—BC, BG
Modulation Prods., 56 Lispenard St., New York 13, N. Y.—BE
Motorola, Inc., 4545 Augusta Blvd., Chicago 51, Ill.—BA, BF, BI
National Electronics Mfg., 42-08 Vernon Blvd., Long Island City 1, N. Y.—BA, BL
Nebel Labs., R. E., 1104 Lincoln Place, Brooklyn 13, N. Y.—BE
Neptune Electronics, 433 Broadway, New York 13, N. Y.—BC, BD
Neutronic Assoc., 83-56 Victor Ave., Elmhurst 73, N. Y.—BG
North Electric Mfg., 501 S. Market St., Galion, Ohio—BD

Opad-Green Co., 71 Warren St., New York 7, N. Y.—BC, BG
Oregon Corvek, 1005 N.W. 16th Ave., Portland 9, Ore.—BA

Pacific Mercury Television Mfg., 5955 Van Nuys Blvd., Van Nuys, Calif.—BG, BH, BI, BJ
Pedersen Electronics, P.O. Box 572, Lafayette, Calif.—BG
Permoflux Corp., 4900 W. Grand Ave., Chicago 39, Ill.—BB
Philco Corp., Gov't & Industrial Div., 4700 Wissahickon Ave., Philadelphia 44, Pa.—BF
Philson Mfg., 60-66 Sackett St., Brooklyn 31, N. Y.—BA
Pickard & Burns, 240 Highland Ave., Needham 94, Mass.—BA
Piezo Prods., Whitney St., Framingham, Mass.—BE
Polytechnic Research & Develop., 55 Johnson St., Brooklyn, N. Y.—BF
Precision Prods., 719 17th St. N.W., Wash., D. C.—BE
Premax Prods., Div., Chisholm Ryder Co., Highland & College Aves., Niagara Falls, N. Y.—BA
Product Development, 307 Bergen Ave., Kearny, N. J.—BA, BF

Radio Corp. of America, RCA Victor Div., Camden, N. J.—BA, BB, BC, BD, BF, BG, BH, BI, BJ, BK, BL
Radio Eng'g Labs., Inc., 36-40 37th St., Long Island City 1, N. Y.—BA, BF, BI
Radio Laboratories, 1846 Westlake North, Seattle 9, Wash.—BB, BH, BI
Radio Sonic Corp., 186 Union, New Rochelle, N. Y.—BG
Radio Specialty Mfg., 2023 S.E. 6th Ave., Portland 14, Ore.—BE
Reeves-Hoffman Corp., 145 Cherry, Carlisle, Pa.—BE
Resdel Eng'g Corp., 2351 Riverside Dr., Los Angeles 39, Calif.—BF
Robinson Aviation, Teterboro Air Terminal, Teterboro, N. J.—BL
Rosen Eng'g Prods., Raymond, 32 & Walnut Sts., Philadelphia 4, Pa.—BF
Rowe Industries, 1702 Wayne, Toledo 9, Ohio—BG

Sierra Electronic Corp., 1050 Brittan Ave., San Carlos, Calif.—BC
Sonar Radio Corp., 59 Myrtle Ave., Brooklyn 1, N. Y.—BH, BI
Sorensen & Co., 375 Fairfield Ave., Stamford, Conn.—BG
Sound Sales & Eng'g Co., 2005 La Branch, Houston 3, Tex.—BD
Standard Crystal Co., 400 Armstrong Ave., Kansas City 1, Kans.—BE
Standard Electronics Corp., 285 Emmet St., Newark 5, N. J.—BC
Standard Piezo Co., 265 Pomfret St., Carlisle, Pa.—BE
Stephens Mfg. Corp., 8539 Warner Dr., Culver City, Calif.—BI
Stone City Machine & Tool Co., 1206 7th St., Bedford, Ind.—BL

Technicraft Labs., Inc., Thomaston Waterbury Rd., Thomaston, Conn.—BF
Tedford Crystal Labs., 4126 Colerain Ave., Cincinnati 23, Ohio—BE
Telechrome, Inc., 88 Merrick Rd., Amityville, L. I., N. Y.—BB, BC, BF, BG, BI
Telectro Industries, 35-16 37th St., Long Island City 1, N. Y.—BL
Telex, Inc., Telex Park, St. Paul, Minn.—BA
Telrex, Inc., Asbury Park, N. J.—BA
Todd-Tran Corp., 752 S. Third Ave., Mt. Vernon, N. Y.—BC, BG
Torngren Co., C. W., 236 Pearl St., Somerville 45, Mass.—BA, BF
Transmitter Equip. Mfg., 345 Hudson St., New York 14, N. Y.—BB, BC, BD, BG, BH
Tri-Dex Co., P.O. Box 1207, Lindsay, Calif.—BG
T-V Prods. Co., 152 Sandford St., Brooklyn 5, N. Y.—BA, BL

U. S. Recording Co., 1121 Vermont Ave., N.W., Washington 5, D. C.—BD, BG
Universal Aviation Co., 230 Park Ave., New York, N. Y.—BD
Universal Electronics, 2012 S. Sepulveda Blvd., Los Angeles 25, Calif.—BC, BG
Utility Electronics Corp., 231 Grant Ave., E. Newark, N. J.—BG, BH, BI

Wadsworth Mfg. Associates, 509 Balsam St., Liverpool, N. Y.—BL
Ward Prods. Corp., Div. of Gabriel Co., 1523 E. 45th St., Cleveland 3, Ohio—BA
Waveline Inc., P. O. Box 470, Caldwell, N. J.
White & Son., James L., 374 Verona Ave., Newark 4, N. J.—BA, BF
Willard Storage Battery, 246 E. 131st St., Cleveland 1, Ohio—BC
Wincharger Corp., E. 7th at Division, Sioux City 2, Iowa—BC
Workshop Associates, Div. of Gabriel Co., Endicott St., Norwood, Mass.—BA

1952 METAL USAGE in RADIO and TELEVISION SETS (Est.)*

Aluminum	3,139 tons
Brass	4,844 tons
Cadmium	119 tons
Cobalt	218 tons
Copper (incl. use in brass)	12,951 tons
Lead	1,790 tons
Nickel	450 tons
Steel & iron	118,915 tons
Tin	534 tons
Zinc (incl. use in brass)	5,745 tons

* Information supplied by RTMA

3—Aviation

Airborne film recorders	CA
Airborne magnetic recorders	CB
Airport controller recorders	CC
Antennas	CD
Antenna accessories	CE
Crystals	CF
Emergency equipment	CG
Intercom systems	CH
Landing systems, airborne	CI
Landing systems, ground	CJ
Navigation equipment, airborne	CK
Navigation equipment, ground	CL
Power supplies	CM
Power supplies, emergency	CN
Power supplies, 400 CPS	CO
Radar	CP
Radio altimeters	CQ
Test equipment	CR
Transmitters	CS
Vibration mountings	CT

Accurate Eng'g Co., 2005 Blue Island Ave., Chicago 8, Ill—CM, CN
Acme Electric Corp., Water St., Cuba, N. Y.—CM, CO
Acorn Electronics Corp., Box 348, Gibson City, Ill—CH, CM, CN, CO, CR
Aero Electronics Co., 1512 N. Wells St., Chicago 10, Ill—CK, CM, CR
Aeronautical Radio Mfg. Co., 155 First St., Mineola, N. Y.—CD, CF, CH, CI, CK, CO, CQ, CT
Ainslie Electronic Prod., Inc., 312 Quincy Ave., Quincy 69, Mass—CD, CE
Air Associates, Inc., 511 Joyce St., Orange, N. J.—CG, CH, CK, CL, CM, CN, CO, CS
Airborne Instruments Lab., 160 Old Country Rd., Mineola, N. Y.—CD, CI, CJ, CK, CL, CP
Airlectron Inc., Box 151, Caldwell, N. J.—CH
Airpax Products Co., Middle River, Baltimore 20, Md—CM, CN, CO
Allied Allegri Machine Co., 141 River Road, Nutley 10, N. J.—CM
Alpar Mfg., 466 St. Francis St., Redwood City, Calif—CD
American Chronoscope Corp., 316 W. First St., Mt. Vernon, N. Y.—CR
American Electroneering Corp., 5025 W. Jefferson Blvd., Los Angeles 16, Calif—CI, CJ, CM, CN, CO, CR, CS
American Hydromath Corp., 145 W. 57th St., New York 19, N. Y.—CK, CL
American Phenolic Corp., 1830 S. 54th Ave., Chicago 50, Ill—CD, CE
American Television & Radio Corp., 300 E. 4th St., St. Paul 1, Minn—CM, CN
Ampex Electric Corp., 934 Charter St., Redwood City, Calif—CB, CC
Amplifier Corp. of America, 398 Broadway, New York 13, N. Y.—CB
Andrew Corp., 363 E. 75th St., Chicago 20, Ill.—CD, CE
Ansley Electronics, Inc., 85 Tremont St., Meriden, Conn.—CD, CE, CP, CS
Antenna Research Lab., Inc., 797 Thomas Lane, Columbus 14, Ohio—CD, CK, CR
Assoc. Eng'g Corp. of Boston, 18 Euston Rd., Brighton 35, Mass—CM
Audio Products Corp., 2265 Westwood Blvd., Los Angeles 64, Calif.—CP
Audio & Video Products Corp., 730 Fifth Ave., New York 3, N. Y.—CB
Aerex Corp., 1117 N. Franklin, Chicago, Ill—CR
Automatic Electric Co., 1033 W. Van Buren St., Chicago 7, Ill—CH
Bardwell & McAlister, 2950 N. Ontario St., Burbank, Calif—CD, CM, CP, CR
Barry Corp., The, 700 Pleasant St., Watertown 72, Mass—CT
Bassett, Inc., Rex, 1314 N. E. 17 Court, Ft. Lauderdale, Fla—CF, CR, CS
Beam Instruments Corp., 350 Fifth Ave., New York 1, N. Y.—CH, CR
Bendix Aviation Corp., Pac. Div., 11600 Sherman Way, N. Hollywood, Calif—CK, CL, CP
Bendix Aviation Corp., Red Bank Div., Eatontown, N. J.—CM, CN, CO
Bendix Radio Div., Bendix Aviation Corp., Baltimore 4, Md—CJ, CK, CL, CP, CS
Berkeley Scientific Corp., 2200 Wright Ave., Richmond Calif.—CR
Berndt-Bach Inc., Auricon Div., 7325 Beverly Blvd., Los Angeles 36, Calif—CA
Beta Electric Corp., 333 E. 103rd St., New York 29, N. Y.—CM
Birnbach Radio Co., 145 Hudson St., New York 13, N. Y.—CE
Billey Electric Co., Union St. Bldg., Erie, Pa.—CF
Boehme, Inc., 915 Broadway, New York 10, N. Y.—CL
Bogue Railway Equip. Div., 52 Iowa Ave., Paterson 5, N. J.—CH, CM, CN, CO
Bone Eng'g Corp., 701 W. Broadway, Glendale 4, Calif—CD, CE, CK, CM, CP, CR
Booth Co., Arthur E., 4124 Beverly Blvd., Los Angeles 4, Calif—CM
Breon Labs., 1520 Evergreen, Williamsport, Pa—CF
Brush Development Co., The, 3405 Perkins Ave., Cleveland 14, Ohio—CB, CR
Bunnell & Co., J. H., 81 Prospect St., Brooklyn 1, N. Y.—CJ, CL, CM, CN, CP, CQ
Burgess Battery Co., Freeport, Ill.—CM, CN
Burnett Radio Lab., Wm. W. L., 4814 Idaho St., San Diego 16, Calif—CF
Camburn, Inc., 32-40 57th St., Woodside 77, N. Y.—CD, CE
Camfield Mfg. Co., Seventh St., Grand Haven, Mich—CD, CE, CH
Carbonneau Industries, Inc., 21 Ionia N. W., Grand Rapids 2, Mich—CR
Cardwell Mfg. Co., A. D., Plainville, Conn—CP
Carter Motor Co., 2654 N. Maplewood Ave., Chicago 47, Ill.—CM, CO
C. G. S. Labs., Inc., 391 Ludlow St., Stamford, Conn—CE, CK, CR
Chatham Electronics Corp., 475 Washington St., Newark 2, N. J.—CM
Collins Radio Co., 855 35th St., N. E., Cedar Rapids, Iowa—CD, CI, CK, CB, CS
Commercial Radio Equip. Co., 1319 "F" St., Washington, D. C.—CF
Commercial Radio Monitoring Co., P. O. Box 7037, Kansas City, Mo.—CF
Communication Devices Co., 2331 12th Ave., New York 27, N. Y.—CK, CL, CM, CN, CP, CQ
Communications Co., 300 Green Ave., Coral Gables 34, Fla.—CS
Condenser Products Co., 7517 N. Clark St., Chicago 26, Ill.—CM, CO
Conn. Telephone & Electric, 70 Britannia St., Meriden, Conn.—CH
Consolidated Eng'g Corp., 300 N. Sierra Madre Villa, Pasadena 15, Calif—CA, CR
Cornell-Dubilier Electric Corp., 333 Hamilton Blvd., S. Plainfield, N. J.—CK, CM, CN, CO
Crouse-Hinds Co., Wolf & 7 North Sts., Syracuse 1, N. Y.—CL
Crystal Research Labs., 29 Allyn St., Hartford, Conn.—CF
Cubic Corp., 2841 Canon St., San Diego 6, Calif—CD, CE, CK, CL, CM, CN, CO, CP, CQ, CR, CS
Daven Co., 193 Central Ave., Newark 4, N. J.—CR
Daystrom Electronic Corp., 837 Main St., Poughkeepsie, N. Y.—CB, CC
Dayton Aviation Radio & Equip. Corp., Hangar No. 2, Dayton Municipal Airport, Box 187, Vandalia, Ohio—CD, CK, CS
Delco Radio Division, Kokomo, Ind—CH, CI, CK, CP
Designers for Industry, 2915 Detroit Ave., Cleveland 13, Ohio—CH, CP, CR
Dictaphone Corp., 420 Lexington Ave., New York 17, N. Y.—CC
Dittmore & Freimuth Co., 2517 E. Norwich St., Cudahy, Wis.—CD, CE, CM, CN
Dorne & Margolin, Sheridan Ave., Bethpage, L. I., N. Y.—CD, CE
D X Radio Products Co., 2300 W. Armitage Ave., Chicago 47, Ill.—CF
Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J.—CI, CK, CM, CO
Edin Co., 207 Main St., Worcester 8, Mass—CH, CR
Elcor, Inc., 1501 W. Congress St., Chicago 7, Ill—CM, CO
Eldson Electronic Co., 1802 N. Third St., P. O. Box 31, Temple, Tex.—CF
Electrodyne Co., 32 Oliver, Boston 10, Mass—CR
Electromagnetics Research Corp., 3210 Winona Ave., Burbank, Calif.—CR
Electronic Development Lab., 41-07 23rd Ave., Long Island City 5, N. Y.—CH, CM, CO
Electro Precision Products, Inc., 119-01 22nd Ave., College Point, N. Y.—CD
Electro Products Labs., 4501 N. Ravenswood Ave., Chicago 40, Ill—CM
Electron-Radar Products, Inc., 1041 N. Pulaski Rd., Chicago 51, Ill—CD, CP, CR
Electro-Tech Equip. Co., 308 Canal St., New York 13, N. Y.—CM, CN, CR
Electrotechnic Corp., 15601 Arrow Highway, Azusa, Calif—CI, CJ, CK, CL, CM, CR, CS
Elm Labs., 18 S. Broadway, Dobbs Ferry, N. Y.—CH
Empire Devices, Inc., 38-25 Bell Blvd., Bayside 61, N. Y.—CR
Engineering Associates, 434 Patterson Rd., Dayton 9, Ohio—CM, CR
Equipment & Service Co., 6815 Oriole Dr., Dallas 8, Tex—CF, CG, CM, CR
Erco Radio Labs., Inc., Stewart Ave., Garden City, N. Y.—CD, CL
Erwood, Inc., 1770 W. Berteau Ave., Chicago 13, Ill—CH
Executone, Inc., 415 Lexington Ave., New York 17, N. Y.—CH
Federal Telecommunication Labs., Inc., 500 Washington Ave., Nutley 10, N. J.—CK, CL
Ferranti Electric, Inc., 30 Rockefeller Plaza, New York 20, N. Y.—CM, CO
Finn & Co., T. R., 333 Jackson Ave., New York 54, N. Y.—CT
Finney Co., The, 4612 St. Clair Ave., Cleveland 3, Ohio—CD
Fischer & Porter Co., 19 County Line Rd., Hatboro, Pa.—CR
Fiske Engineering Co., John, Box 755, Springdale, Conn.—CM
Furst Electronics, 3322 W. Lawrence Ave., Chicago 25, Ill—CM, CR
Gadgets, Inc., 3629 N. Dixie Dr., Dayton 4, Ohio—CD, CE, CP, CR
Garod Radio Corp., 70 Washington St., Brooklyn 1, N. Y.—CR
Gates Radio Co., 123 Hampshire St., Quincy 1, Ill.—CM, CS
General Communication Co., 681 Beacon St., Boston 15, Mass—CP, CR
General Electrosonics, Inc., 32 W. 22 St., New York 10, N. Y.—CR
Genisco, Inc., 2233 Federal Ave., Los Angeles 64, Calif.—CK
Georator Corp., 1820 N. Nash St., Arlington 9, Va.—CM, CN, CO
Gilfillan Bros., Inc., 1815 Venice Blvd., Los Angeles 6, Calif—CJ, CP
G & M Equipment Co., 7315 Varna Ave., North Hollywood, Calif—CK, CR, CS, CT
Goslin Elec. & Mfg. Co., 2021 W. Olive Ave., Burbank, Calif—CP
Gulton Mfg. Corp., 212 Durham Ave., Metuchen, N. J.—CF, CR
G. W. Associates, P. O. Box 2263, El Segundo, Calif.—CD, CE
Hamilton Kent Mfg. Co., Kent, Ohio—CT
Hartman Engineering Co., 117 Oakland St., Springfield, Mass—CM, CR
Harvey Radio Labs., 447 Concord Ave., Cambridge 38, Mass.—CD
Harvey-Wells Electronics, Inc., North St., Southbridge, Mass—CE, CR
Hastings Instrument Co., Super Highway & Pine Ave., Hampton, Va—CI, CJ, CK, CL
Heller & Associates, Herman S., 8414 W. 3 St., Los Angeles 48, Calif—CB, CC
Heppner Mfg. Co., Round Lake, Ill—CT
Hertner Electric Co., The, 12690 Elmwood Ave., Cleveland 11, Ohio—CM, CN, CO
Hewlett-Packard Co., 395 Page Mill Rd., Palo Alto, Calif.—CR
Heyman Mfg. Co., 300 Michigan, Kenilworth, N. J.—CF
Highland Engineering Co., Main & Urban, Westbury, L. I., N. Y.—CM, CN, CO
Hillyer Instrument Co., 54 Lafayette St., New York 13, N. Y.—CR
Holub Industries, 413 DeKalb Ave., Sycamore, Ill—CE, CR
Howard Industries, 1760 State St., Racine, Wis—CN
Hughes Research & Devel. Labs., H. A. C. Div., Hughes Tool Co., Culver City, Calif—CP
Hughey & Phillips, 4075 Beverly Blvd., Los Angeles 4, Calif—CJ
Hull & Co., R. O., 1300 Parsons Court, Rocky River, Ohio—CM
Hunt Corp., 453 Lincoln St., Carlisle, Pa—CF
Hunt Engineering Co., 24 Broad, Summit, N. J.—CR
Imperial Radar & Wire Corp., 1312 Bronx Blvd., Bronx 66, N. Y.—CE, CP
INET, Inc., 8655 S. Main St., Los Angeles 3, Calif—CM, CN, CO, CR
Insuline Corp. of America, 36-02 35 Ave., Long Island City 1, N. Y.—CC, CE, CF, CT
International Research Associates, A Div. of Ireseo, Inc., 2221 Warwick Ave., Santa Monica, Calif.—CK, CM, CO, CQ, CR, CS
Jarvis Electronic Corp., 6058 W. Fullerton Ave., Chicago 39, Ill—CK, CR, CS
Kalbfell Labs., Inc., 1090 Morena Blvd., P. O. Box 1578, San Diego 10, Calif—CS
Kay Electric, Maple Ave., Pine Brook, N. J.—CR
Kellogg Switchboard & Supply Co., 6650 S. Cicero Ave., Chicago 38, Ill—CH
Kepco Labs., Inc., 131-38 Sanford Ave., Flushing 55, N. Y.—CM, CN, CO
Kinetix Instrument Co., 902 Broadway, New York 10, N. Y.—CP
Kings Microwave Co., 50 Marbledale Ave., Tuckahoe, N. Y.—CD, CR
Knights Co., James, Sandwich, Ill—CF
Kollsman Instrument Corp., Elmhurst, N. Y.—CK
Korb Engineering & Mfg. Co., 30 Ottawa Ave., Grandville, Mich—CR, CP
Korfund Co., The, 48-15 32 Place, Long Island City 1, N. Y.—CT
Krohn-Hite Instrument Co., 580 Massachusetts Ave., Cambridge 39, Mass—CR
Laboratory for Electronics, 75 Pitt St., Boston 14, Mass—CI, CJ, CK, CL, CP, CR
Lake Mfg. Co., 2323 Chestnut, Oakland 7, Calif—CH
Lambda Electronics Corp., 103-02 Northern Blvd., Corona 68, N. Y.—CM
Langevin Mfg. Corp., 37 W. 65 St., New York 23, N. Y.—CH, CM, CN, CO
Lear, Inc., 11916 W. Pico Blvd., Los Angeles 64, Calif—CK, CS
Lee Electric & Mfg. Co., 2806 Clearwater St., Los Angeles 39, Calif—CM, CN
Loro Labs., 360 Bleecker, New York 14, N. Y.—CP
Link Aviation, Binghamton, N. Y.—CJ, CL
Lockheed Aircraft, Burbank, Calif—CS
Loral Electronics Corp., 794 E. 140 St., New York 54, N. Y.—CK, CP
Lord Mfg. Co., Erie, Pa—CT
Lyman Electronic, 12 Cass St., Springfield, Mass—CR
Lytle Engineering & Mfg. Co., 4721 N. Kedzie Ave., Chicago 25, Ill—CG
Marconi's Wireless Telegraph, 23 Beaver St., New York 4, N. Y.—CD, CE, CF, CG, CH, CI, CJ, CK, CL, CM, CN, CR, CS, CT
McColpin-Christie Corp., 3410 W. 67 St., P. O. Box 19665, Los Angeles 43, Calif—CM
Magnavox Co., Bueter Rd., Ft. Wayne 4, Ind—CH, CK, CP, CS
Magnecord, Inc., 225 W. Ohio, Chicago, Ill—CB
Mark Products Co., 5547-49 Montrose Ave., Chicago 18, Ill—CD, CE
Maurer, Inc., J. A., 37-01 31 St., Long Island City 1, N. Y.—CA
Maryland Electronic Mfg. Corp., 5009 Calvert Rd., College Park, Md—CJ, CL
Marconi Instruments Ltd., 23 Beaver St., New York, N. Y.—CR
Melpar, Inc., 452 Swann Ave., Alexandria, Va—CP
Menlo Research Lab., Menlo Park, Calif—CR
Mercury Electronic Co., Box 450, Red Bank, N. J.—CM, CN, CO, CR
Micro Eng'g Corp., 6233 Hollywood Blvd., Hollywood 28, Calif—CA, CR
Microlab, 301 S. Ridgewood, S. Orange, N. J.—CR
Midco Mfg. Co., 607 N. 8, Sheboygan, Wisc—CM
Midwestern Geophysical Lab., 3401 S. Harvard Ave., Tulsa, Okla—CA
Millen Mfg. Co., James, 150 Exchange St., Malden 48, Mass—CR
Mitchell Industries, Inc., P. O. Box 17, Mineral Wells, Tex—CD, CE, CF, CG, CH, CK, CS

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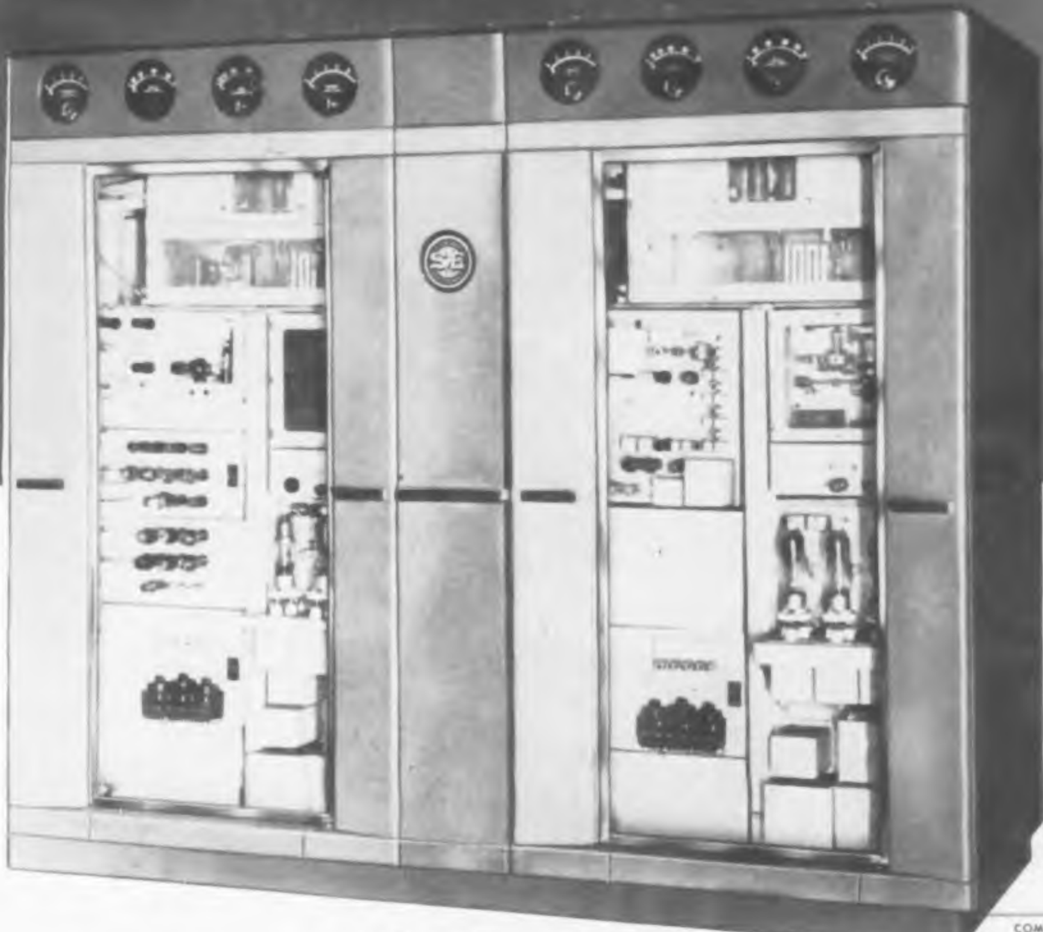

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Approx. cost - 1 Set of tubes	$1400	$1500	$1600	$1700	$3000
Approx. power consump (aver. pic.)	15KW	18KW	25KW	23KW	25KW
Similarity of tube line up, aural and visual	YES	NO	NO	YES	NO
Physical length	178 in.*	180 in.	199 in.	215 in.	208 in.
Self contained, both bands	YES	NO	NO	NO	NO
Air cooled, both bands	YES	YES	YES	YES	NO
Factory adjusted side band filter	YES	NO	YES	NO	YES
Ability to use driver as stand by transmitter	YES	NO	NO	NO	NO

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National Aeronautical Corp., 180 S. Main St., Ambler, Pa.—CD, CI, CK, CM, CR, CS
National Electronics Mfg. Corp., 42-08 Vernon Blvd., Long Island City 1, N. Y.—CD, CF, CT
Nebel Lab., R. E., 1104 Lincoln Place, B'klyn, N. Y.—CF
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N.R.K. Mfg. & Eng'g., 4601 W. Addison St., Chicago 41, Ill.—CP
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Northern Radio, 314 Bell St., Seattle 1, Wash.—CS
Northern Zaleski, Ltd., Pratt Oval, Glen Cove, L. I., N. Y.—CR
Northrop Aircraft, 7? Broadway, Hawthorne, Calif.—CS

O'Brien Electric Co., 6514 Santa Monica Blvd., Hollywood 38, Calif.—CH
Offner Electronics, 5320 N. Kedzie Ave., Chicago 25, Ill.—CR
Olesen Co., Otto K., 1534 Cahuenga Blvd., Hollywood 28, Calif.—CH
Opad-Green Co., 71 Warren, New York, N. Y.—CM, CN
Oregon Corvek Co., 1005 N. W. 16 Ave., Portland 9, Ore.—CG

Pacific Mercury Television Mfg. Corp., 5955 Van Nuys Blvd., Van Nuys, Calif.—CG, CI, CK, CR, CS
Packard-Bell Co., 12333 W. Olympic Blvd., Los Angeles 64, Calif.—CH, CP
Parsons Co., The Ralph M., 689 S. Fair Oaks Ave., Pasadena 2, Calif.—CK, CL, CQ
PCA, Inc., 6368 DeLongpre Ave., Hollywood 28, Calif.—CM, CO
Pedersen Electronics, Mt. Diablo Blvd., P. O. Box 572, Lafayette, Calif.—CM
Peirce Wire Recorder Corp., 1328 Sherman, Evanston, Ill.—CR
Permoflux Corp., 4900 W. Grand Ave., Chicago 39, Ill.—CK, CL
Phaostron Co., 151 Pasadena Ave., South Pasadena, Calif.—CC, CD, CR
Philco Corp., Government & Industrial Div., 4700 Wissahickon Ave., Philadelphia 44, Pa.—CK, CP
Pallson Mfg. Co., 60-66 Sackett St., Brooklyn 31, N. Y.—CD, CE
Pickard & Burns, 240 Highland Ave., Needham 94, Mass.—CD
Piezo Products Co., Framingham, Mass.—CF
Polytechnic Research & Development Co., 55 Johnson St., Brooklyn, N. Y.—CR
Porcelain Products, Inc., Box 830, Parkersburg, W. Va.—CE
Portable Electric Tools, Inc., 340 W. 83 St., Chicago, Ill.—CM, CO
Power Equip. Co., 55 Antoinette St., Detroit 2, Mich.—CM, CO
Precision Piezo Service, 427 Mayflower St., Baton Rouge 10, La.—CF
Precision Products, Inc., 719 17 St., N. W., Washington, D. C.—CF, CK, CL
Premax Products Div., Chisholm-Ryder Co., Highland & College Aves., Niagara Falls, N. Y.—CD, CE
Premier Electronics Labs., 382 Lafayette St., New York 3, N. Y.—CR

Radiart Corp., 3455 Vega, Cleveland 13, Ohio—CM
Radio Corp. of America, RCA-Victor Div., Camden, N. J.—CD, CE, CF, CI, CJ, CK, CL, CP, CQ, CS
Radio Labs., Inc., 1845 Westlake North, Seattle 9, Wash.—CH, CM, CN, CS
Radiomarine Corp. of America, 75 Varick St., New York 13, N. Y.—CP
Radio-Music Corp., 84 S. Water St., Port Chester, N. Y.—CD
Radio Receptor Co., 251 W. 19 St., New York 11, N. Y.—CI, CJ, CK, CL, CS
Radio Sonic Corp., 186 Union Ave., New Rochelle, N. Y.—CR
Radio Specialty Mfg. Co., 2023 S. E. 6 Ave., Portland 14, Ore.—CF
Radio Transceiver Labs., 116-23 Jamaica Ave., Richmond Hill 18, N. Y.—CS
Reeves-Hoffman Corp., 145 Cherry, Carlisle, Pa.—CF
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Resdel Engineering Corp., 2351 Riverside Dr., Los Angeles 39, Calif.—CD, CE, CG, CI, CJ, CK, CL, CO, CP, CR, CS
Robinson Aviation, Inc., Teterboro, N. J.—CT
Rowe Industries, 1702 Wayne St., Toledo 9, Ohio—CM, CR

Schuttig & Co., 9th & Kearny Sts., N. E., Washington 17, D. C.—CD, CI, CK, CL, CM, CQ, CS
Seaboard Electric Co., 417 Canal St., New York 13, N. Y.—CH, CP, CR
Sealtron Co., The, 9701 Reading Rd., Cincinnati 15, Ohio—CR
Servomechanisms, Inc., Post & Stewart Aves., Westbury, N. Y.—CM
Shallcross Mfg. Co., Pusey & Jackson Aves., Collingdale, Pa.—CR
Shevers, Inc., Harold, 123 W. 64 St., New York 23, N. Y.—CH, CM, CO, CP, CR
Sierra Electronic Corp., 1050 Brittan Ave., San Carlos, Calif.—CM, CO, CR
Simpson Electric Co., 5200 W. Kinzie St., Chicago 44, Ill.—CR
Simpson Mfg. Co., Mark, 32-28 49 St., Long Island City 3, N. Y.—CH
Snyder Mfg. Co., 22nd & Ontario Sts., Philadelphia 40, Pa.—CD, CE
Sonar Radio Corp., 59 Myrtle Ave., Brooklyn 1, N. Y.—CD, CF, CG, CI, CM, CS
Sorensen & Co., 375 Fairfield Ave., Stamford, Conn.—CM
Southwestern Industrial Electronics Co., 2831 Post Oak Rd., Houston 19, Tex.—CR
Special Products Co., 9115 Brookville Rd., Silver Spring, Md.—CR
Specialty Airtronics, Inc., 102 Warren St., New York, N. Y.—CD, CE, CK, CM, CO, CP, CT
Spellman Television Co., 3029 Webster Ave., New York 67, N. Y.—CM
Sperry Gyroscope Co., Div. of The Sperry Corp., Great Neck, L. I., N. Y.—CJ, CK, CL, CP, CR
Square Root Mfg. Co., 391 Saw Mill River Rd., Yonkers 2, N. Y.—CD, CE, CL, CM, CO, CP, CR
Standard Crystal Co., 400 Armstrong Ave., Kansas City 1, Kans.—CF
Standard Electrical Products, 400 E. First St., Dayton 2, Ohio—CH, CM, CO
Standard Electronics Corp., 285 Emmet St., Newark 5, N. J.—CF
Standard Piezo Co., 265 Pomfret, Carlisle, Pa.—CF
Star Expansion Products Co., 147 Cedar St., New York 6, N. Y.—CE
Stelma, Inc., 389 Ludlow, Stamford, Conn.—CH, CR
Stone City Machine, 1206 7th St., Bedford, Ind.—CT.

Taflet Radio & TV Co., 2530 Belmont Ave., New York 58, N. Y.—CH
Tartak-Stolle Electronics, 3070 S. Grand Ave., Los Angeles 37, Calif.—CH
Tech Labs., Inc., Bergen & Edsall Blvd., Palisades Park, N. J.—CR
Technical Appliance Corp., 1 Taco St., Sherburne, N. Y.—CD, CE
Tedford Crystal Labs., 4126 Colerain Ave., Cincinnati 23, Ohio—CF
Tektronix, Inc., Box 831, Portland, Ore.—CR
TelAutograph Corp., 16 W. 61 St., New York 23, N. Y.—CM, CN, CO, CR, CS
Telechrome, Inc., 88 Merrick Rd., Amityville, L. I., N. Y.—CR
Telectro Industries Corp., 35-16 37 St., Long Island City 1, N. Y.—CB, CD, CG, CH, CM, CP, CR, CT
Telemarine Communications Co., 536-542 W. 27th St., New York 1, N. Y.—CI, CP, CS
Teletronic Labs., Inc., 1835 W. Rosecrans Ave., Gardena, Calif.—CR
Thompson Products, Inc., 2196 Clarkwood Rd., Cleveland 3, Ohio—CD
Todd-Tran Corp., 752 S. Third Ave., Mt. Vernon, N. Y.—CN, CO
Torngren Co., C. W., 236 Pearl St., Somerville 45, Mass.—CD, CP
Transformer Technicians, 2608 N. Cicero Ave., Chicago 39, Ill.—CM, CN, CO
Transitron, Inc., 154 Spring St., New York 12, N. Y.—CD, CE, CK, CP, CQ, CR, CS
Transmitter Equipment Mfg. Co., 345 Hudson St., New York 14, N. Y.—CG, CH, CM, CP, CS
Trans-Sonics, Bedford Airport, Bedford, Mass.—CR
Triplett Electrical Instrument Co., Harmon Rd., Bluffton, Ohio—CR
T-V Products Co., 152 Sandford St., Brooklyn 5, N. Y.—CD, CT

U. S. Motors, 584 Nebraska St., Oshkosh, Wisc.—CN
U. S. Recording Co., 1121 Vermont Ave., N. W., Washington 5, D. C.—CM
Universal Electronics Co., 2012 S. Sepulveda Blvd., Los Angeles 25, Calif.—CM
Utility Electronics Corp., 231 Grant Ave., E. Newark, N. J.—CI, CJ, CK, CL, CM, CP, CQ

Valpey Crystal Corp., Box 325, Holliston, Mass.—CF
Varo Mfg. Co., 1801 Walnut, Garland, Tex.—CM, CO
Vincent Co., A. W., 163 St. Paul St., Rochester 4, N. Y.—CH
Vocaline Co. of America, Inc., Coulter St., Old Saybrook, Conn.—CH
Vokar Corp., 7300 Huron River Dr., Dexter, Mich.—CM, CN
Wadsworth Mfg. Associates, 500 Balsam St., Liverpool, N. Y.—CT

Ward Products Corp., Div. of The Gabriel Co., 1523 E. 45 St., Cleveland 3, Ohio—CD, CE
Waveline Inc., P. O. Box 470, Caldwell, N. J.—CP
Webster Electric, 1900 Clark, Racine, Wis.—CH
Welch Electric Co., 1221 Wade St., Cincinnati 14, Ohio—CM, CO, CR
Westinghouse Electric Corp., 2519 Wilkens Ave., Baltimore 3, Md.—CS
Weston Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5, N. J.—CR
Wilcox Electric Co., 1400 Chestnut St., Kansas City 1, Mo.—CD, CE, CF, CG, CI, CJ, CK, CL, CM, CP, CR, CS
Wincharger Corp., E. 7 at Division, Sioux City 2, Iowa—CN
Wind Turbine Co., E. Market St. & P.R.R., West Chester, Pa.—CD
Workshop Associates, The, Div. of The Gabriel Co., Endicott St., Norwood, Mass.—CD, CE

Z & W Machine Products Inc., Electronics Div., 5100 St. Clair Ave., Cleveland 3, Ohio—CD

4—Police, Industrial, Common Carrier, Marine, Railroad, Public Safety, Civilian Defense, etc.

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Aeronautical Communications Equip., 3090 Douglas Rd., Miami 33, Fla.—DO, DP, DR
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Airpax Prods., Middle River, Baltimore, Md.—DL, DM
Airplane & Marine Instruments, Clearfield, Pa.—DL, DQ
All Channel Antenna Corp., 70-07 Queens Blvd., Woodside 77, N. Y.—DA
Allied Allegri, 141 River Rd., Nutley 10, N. J.—DL
Alpar Mfg. 466 St. Francis, Redwood City, Calif.—DB
Altec Lansing Corp., 9356 Santa Monica Blvd., Beverly Hills, Calif.—DE, DI
American Electroneering, 5025 W. Jefferson Blvd., Los Angeles 16, Calif.—DA, DE, DL, DM, DO, DP, DR
American Microphone Co., 370 S. Fair Oaks Ave., Pasadena 1, Calif.—DI
American Phenolic Corp., 1830 S. 54th Ave., Chicago 50, Ill.—DA
American Radiotelephone Co., 3505 4 St. N., St. Petersburg, Fla.—DE
American Television & Radio, 300 E. 4th St., St. Paul 1, Minn.—DL, DM
Andrew Corp., 363 E. 75th, Chicago 20, Ill.—DA
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Bassett, Inc., Rex, 1314 N.E. 17 Court, Ft. Lauderdale, Fla.—DF, DO, DP, DQ, DR
Beam Instruments Corp., 350 Fifth Ave., New York 1, N. Y.—DI
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Berndt-Bach, Inc., Auricon Div., 7325 Beverly Blvd., Los Angeles 36, Calif.—DG
Beta Electric Corp., 333 E. 103rd St., New York 29, N. Y.—DL
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Boehme, Inc., 915 Broadway, New York 10, N. Y.—DE
Bogue Railway Equip. Div., Bogue Electric Mfg., 52 Iowa Ave., Paterson 5, N. J.—DH, DL, DM
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Booth Co., Arthur E., 4124 Beverly Blvd., Los Angeles 4, Calif.—DL
Brelco Electronic Corp., 55 Vandam St., New York 13, N. Y.—DC, DO, DP
Breon Labs., 1520 Evergreen, Williamsport, Pa.—DF
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Chatham Electronics Corp., 475 Washington St., Newark 2, N. J.—DL
Cinema Engineering Co., 1510 W. Verdugo Ave., Burbank, Calif.—DI
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Commercial Radio Equip., 1319 "F" St., Washington, D. C.—DF
Commercial Radio Monitoring Co., P. O. Box 7037, Kansas City, Mo.—DF
Communications Co., 300 Greco Ave., Coral Gables 34, Fla.—DA, DE, DO, DP, DQ, DR
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Crystal Research Labs., 29 Allyn St., Hartford, Conn.—DI
Cubic Corp., 2841 Canon St., San Diego 6, Calif.—DA, DN, DO, DP, DQ, DR
Custom Craft Mfg. Co., 256 E. 98th St., Brooklyn, N. Y.—DE, DR

Danbury-Knudsen, Inc., Danbury, Conn.—DA
Daven Co., 191 Central Ave., Newark 4, N. J.—DE
Davis Electronics, 4313 W. Magnolia Blvd., Burbank, Calif.—DA
Daystrom Electronic Corp., 937 Main St., Poughkeepsie, N. Y.—DG
Delco Radio Div., Kokomo, Ind.—DI, DO, DP, DQ
Designers for Industry Inc., 2915 Detroit Ave., Cleveland 13, Ohio—DE, DH, DO, DP, DT
Dielectric Products Co., 125 Virginia Ave., Jersey City 5, N. J.—DA
Dittmore & Freimuth Co., 2517 E. Norwich St., Cudahy, Wisc.—DA, DB, DL, DM
Dollar Co., Robert, Comm. Equip. Div., 50 Drumm St., San Francisco 11, Calif.—DO, DR
Doolittle Radio Inc., 7421 Loomis Blvd., Chicago 36, Ill.—DJ, DT
Dorne & Margolin, Sheridan Ave., Bethpage, L. I., N. Y.—DA
Dukane Corp., 110 N. 11 St., St. Charles, Ill.—DH
D K Radio Products Co., 2400 W. Armitage Ave., Chicago 47, Ill.—DF

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Electron Enterprises, 6017 W. Stanley Ave., Berwyn, Ill.—DT
Electronic Development Lab., 13-07 23 Ave., Long Island City 5, N. Y.—DH, DL
Electronic Rectifiers, Inc., 2102 Spann Ave., Indianapolis 3, Ind.—DL, DM
Electronic Research & Mfg. Corp., 1420 E. 25th St., Cleveland 14, Ohio—DD, DE, DH, DJ, DO, DP, DR
Electronics Contracting Co., 42 New St., New York 7, N. Y.—DQ
Electron-Radar Products, Inc., 1041 N. Pulaski Rd., Chicago 51, Ill.—DN
Electro Precision Products, 119-01 22 Ave., College Point, N. Y.—DA
Electro Products Labs., 4501 N. Ravenswood Ave., Chicago 40, Ill.—DL
Electro-Tech Equip. Co., 308 Canal St., New York 13, N. Y.—DL, DM
Electrotechnic Corp., 15601 Arrow Highway, Azusa, Calif.—DC, DD, DE, DJ, DL, DO, DP, DQ, DR, DT
Electro-Voice, Inc., Cecil & Carroll Sts., Buchanan, Mich.—DI
Elex Co., The, 69-19 215 St., Bayside, L. I., N. Y.—DD, DH, DI, DL

Elm Laboratories, 18 S. Broadway, Dobbs Ferry, N. Y.—DH, DO
Eltron, Inc., 407 N. Jackson, Jackson, Mich.—DE, DL
Eng'g Research & Development Co., P. O. Box 160, Hinsdale, Ill.—DE, DL
Equipment & Service Co., 6815 Oriole Dr., Dallas 9, Tex.—DF, DL
Erwood, Inc., 1770 W. Berteau Ave., Chicago 13, Ill.—DL, DM
Executone, Inc., 415 Lexington, New York, N. Y.—DH

Farmers Eng'g & Mfg. Co., Irwin, Pa.—DE, DH, DO, DQ, DR
Federal Mfg. & Eng'g Corp., 211-217 Steuben St., Brooklyn 5, N. Y.—DO
Federal Telephone & Radio Corp., 100 Kingsland Rd., Clifton, N. J.—DA, DB, DE, DO, DP, DR
Ferranti Electric, Inc., 30 Rockefeller Plaza, New York 20, N. Y.—DL
Finn & Co., 333 Jackson Ave., New York 54, N. Y.—DS
Finney Co., 4612 St. Clair, Cleveland 3, Ohio—DA
Fisher Research Lab., 1961 University Ave., Palo Alto, Calif.—DQ
Flock Process Co., 31 Fahey, Springdale, Conn.—DS
Fluke Eng'g Co., Box 755, Springdale, Conn.—DL
Furst Electronics, 3322 W. Lawrence Ave., Chicago 25, Ill.—DL

Gates Radio Co., 123 Hampshire St., Quincy 1, Ill.—DI, DL, DR
General Communication Co., 681 Beacon St., Boston 15, Mass.—DN
General Electric Co., Electronics Div., Electronics Park, Syracuse, N. Y.—DA, DB, DE, DF, DI, DN, DO, DP, DR
General Electrosonics, Inc., 32 W. 22nd St., New York 10, N. Y.—DL
Georator Corp., 1820 N. Nash, Arlington, Va.—DL, DM
G & M Equipment Co., 7315 Varna Ave., N. Hollywood, Calif.—DB, DK, DO, DP, DQ, DR
Gonset Co., 801 S. Main St., Burbank, Calif.—DP
Gray Radio Co., 501 Forest Hill Blvd., W. Palm Beach, Fla.—DP, DR
Gulton Mfg. Corp., 212 Durham, Metuchen, N. J.—DF
Hallicrafters Co., 4401 W. Fifth Ave., Chicago 24, Ill.—DO, DP
Hamilton Kent Mfg. Co., Kent, Ohio—DS
Hammarlund Mfg. Co., 460 W. 34th St., New York 1, N. Y.—DL, DO
Harvey Radio Labs., 447 Concord Ave., Cambridge 38, Mass.—DA, DE, DF, DL, DO, DP, DQ, DR
Harvey-Wells Electronics, Inc., North St., Southbridge, Mass.—DE, DJ, DP, DQ, DT
Heller & Assoc., Herman S., 8414 W. 3rd St., Los Angeles 48, Calif.—DG
Heyman Mfg. Co., 300 Michigan, Kenilworth, N. J.—DF
Highland Eng'g Co., Main & Urban, Westbury, L. I., N. Y.—DL, DM
Hoffman Radio Corp., 6200 S. Avalon Blvd., Los Angeles 3, Calif.—DN, DO, DQ, DT

Holtzer-Cabot, 125 Amory St., Boston, Mass.—DK
Howard Industries, 1760 State, Racine, Wis.—DM
Hull & Co., 1300 Parsons Ct., Rocky River, Ohio—DL
Hunt Corp., 453 Lincoln St., Carlisle, Pa.—DF
Hy-Lite Antennae, Inc., 242 E. 137th St., New York 51, N. Y.—DA

Ideco Div., Dresser-Stacey Co., 875 Michigan Ave., Columbus 8, Ohio—DB
INET, Inc., 8655 S. Main St., Los Angeles 3, Calif.—DE, DL, DM
Insuline Corp. of America, 36-02 35 Ave., Long Island City 1, N. Y.—DT
International Rectifier Corp., 1521 E. Grand Ave., El Segundo, Calif.—DL
International Research Assoc., 2221 Warwick Ave., Santa Monica, Calif.—DH, DI, DJ, DL, DO, DP, DR, DT
Intervox Corp., 1846 Westlake N., Seattle 9, Wash.—DA, DH, DQ, DR
Ionic Electronic Equip. Co., 1707 N. Kenmore, Los Angeles 27, Calif.—DE

Jefferson, Inc., Ray, 40 E. Merrick Rd., Freeport, N. Y.—DA, DP, DQ, DR

Kaar Eng'g Co., P. O. Box 1320, Palo Alto, Calif.—DF, DO, DP, DQ, DR
Kalbfell Labs., Inc., P. O. Box 1578, San Diego 10, Calif.—DE, DL, DO, DP, DR
Kellogg Switchboard & Supply Co., 6650 S. Cicero Ave., Chicago 38, Ill.—DL, DK
Kemtron Electron Products, 23 Brown St., Salem, Mass.—DF
Kepco Labs., Inc., 131-38 Sanford Ave., Flushing 55, N. Y.—DL, DM
Key Electronics Corp., 20 W. 22nd St., New York 10, N. Y.—DH
Kings Microwave Co., 50 Marbledale Ave., Tuckahoe, N. Y.—DA
Knights Co., James, Sandwich, Ill.—DF
Korb Eng'g & Mfg. Co., 30 Ottawa Ave., Grandville, Mich.—DD, DN, DP, DQ, DT

Laboratory for Electronics, 75 Pitts St., Boston 14, Mass.—DN
Lake Mfg., 2323 Chestnut, Oakland 7, Calif.—DH
Lambda Electronics Corp., 103-02 Northern Blvd., Corona 68, N. Y.—DL
Langevin Mfg. Corp., 37 W. 65th St., New York 23, N. Y.—DH, DL, DM
LaPointe Plascomold Corp., 155 W. Main St., Rockville, Conn.—DA, DB
Laurehk Radio Mfg. Co., 3927 Monroe Ave., Wayne, Mich.—DO, DP
Lee Electric & Mfg. Co., 2806 Clearwater St., Los Angeles 39, Calif.—DL
Lenkurt Electric Co., 1105 Country Rd., San Carlos, Calif.—DE, DL
Lettine Radio Mfg. Co., 62 Berkley St., Valley Stream, L. I., N. Y.—DR
Lingo & Son, Inc., John E., 2814 Buren Ave., Camden 5, N. J.—DA
Lorain County Radio Corp., The, 203 Ninth St., Lorain, Ohio—DP, DQ, DR
Lord Mfg. Co., 1635 W. 12th St., Erie, Pa.—DS
Lumenite Electronic Co., 407 S. Dearborn St., Chicago 5, Ill.—DE
Lysco Mfg. Co., 1401 Clinton St., Hoboken, N. J.—DA, DL, DO, DP, DR, DT

Magna Electronics Co., 9810 Anza Ave., Inglewood, Calif.—DA, DD, DE, DO
Mallory & Co., P. R., 3029 E. Washington St., Indianapolis 6, Ind.—DL, DM
Mark Products Co., 3547-49 Montrose Ave., Chicago 18, Ill.—DA, DB, DD
Maurer, Inc., J. A., 37-01 31 St., Long Island City 1, N. Y.—DG
McColpin-Christie Corp., P. O. Box 19665, Los Angeles 43, Calif.—DL
Mercury Electronic Co., Box 150, Red Bank, N. J.—DL, DM
Micro-Electronic, 11 W. 5th St., Peru, Ind.—DP
Micro Eng'g Corp., 6233 Hollywood Blvd., Hollywood 28, Calif.—DG, DI
Mideo Mfg. Co., 607 N. 8th St., Sheboygan, Wis.—DL, DM
Millen Mfg. Co., James, 150 Exchange St., Malden 48, Mass.—DL
Model Rectifier Corp., 557 Rogers Ave., Brooklyn 25, N. Y.—DL, DM
Modulation Products Co., 56 Lispenard St., New York 13, N. Y.—DF
Motorola, Inc., 4545 Augusta Blvd., Chicago 51, Ill.—DE, DH, DL, DM, DO, DP, DQ, DR, DT

National Co., 61 Sherman, Malden 48, Mass.—DO
National Electronics Labs., 1711 Kalorama Rd., N. W., Washington 9, D. C.—DP, DR
National Electronics Mfg. Corp., 42-08 Vernon Blvd., Long Island City 1, N. Y.—DA
National Inter-Communicating System, 1130 N. Milwaukee, Chicago 26, Ill.—DH, DL
Nebel Lab., 1104 Lincoln Pl., B'klyn 13, N. Y.—DG
Neptune Electronics Co., 433 Broadway, New York 13, N. Y.—DE, DH, DL, DM
Neutronic Assoc., 83-56 Victor Ave., Elmhurst 73, N. Y.—DL, DM
North Electric Mfg. Co., 501 S. Market St., Galion, Ohio—DE, DH
Northern Radio Co., 314 Bell St., Seattle 1, Wash.—DO, DR

O'Brien Electric Co., 6514 Santa Monica Blvd., Hollywood 38, Calif.—DE, DH
Olesen Co., Otto K., 1534 Cahuenga Blvd., Hollywood 28, Calif.—DH, DL, DM
Opad-Green Co., 71 Warren, New York, N. Y.—DL, DM
Oregon Corvek Co., 1005 N. W. 16 Ave., Portland 9, Ore.—DA, DO, DP, DQ, DR

Pacific Mercury Television Mfg. Corp., 5955 Van Nuys Blvd., Van Nuys, Calif.—DD, DJ, DQ, DR, DT
Palmer, Inc., M. V., 4002 Fruit Valley Rd., Vancouver, Wash.—DO, DR
PCA, Inc., 6368 DeLongpre Ave., Hollywood 28, Calif.—DE, DL, DO, DP, DQ, DR, DT
Pearce Simpson, Inc., 3023 Coral Way, Miami 44, Fla.—DA, DJ, DO, DP, DQ, DR, DT
Pedersen Electronics, Box 572, Lafayette, Calif.—DL
Perma-Power Co., 4721 N. Damen, Chicago, Ill.—DL

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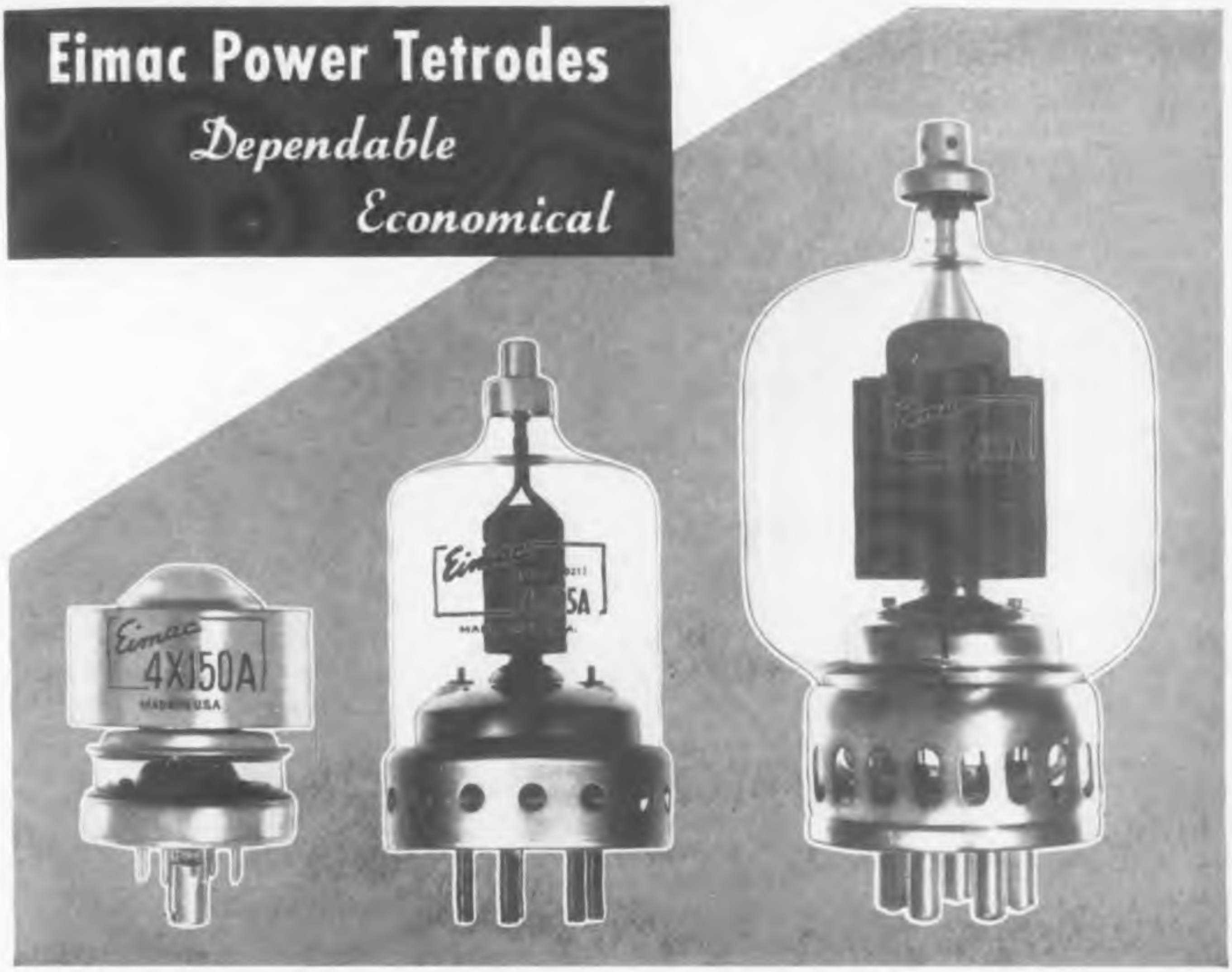

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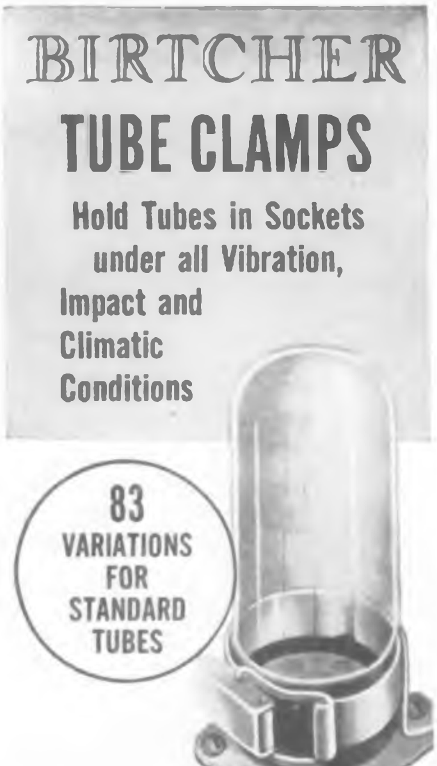

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Pickard & Burns, 240 Highland, Needham 94, Mass.—DA
Piezo Products Co., Framingham, Mass.—DF
Power Equip. Co., 55 Antoinette St., Detroit 2, Mich.—DL
Precision Piezo Service, 427 Mayflower St., Baton Rouge 10, La.—DF
Precision Products, Inc., 719 17th St., N. W., Washington, D. C.—DF
Premax Products Div., Highland & College Aves., Niagara Falls, N. Y.—DA, DR
Product Development Co., 307 Bergen, Kearny, N. J.—DA
Radiart Corp., 3455 Vega, Cleveland 13, Ohio—DL
Radio Apparatus Corp., 55 N. New Jersey St., Indianapolis 4, Ind.—DO, DP
Radio Corporation of America, RCA-Victor Div., Camden, N. J.—DA, DE, DF, DG, DH, DI, DN, DO, DP, DQ, DR
Radio Eng'g Labs., Inc., 36-40 37th St., Long Island City 1, N. Y.—DA, DO, DR
Radio Labs., Inc., 1846 Westlake North, Seattle 9, Wash.—DC, DD, DE, DH, DI, DM, DO, DP, DQ, DR
Radiomarine Corp. of America, 75 Varick St., New York 13, N. Y.—DP, DR
Radiophone, 600 E. Evergreen, Monrovia, Calif.—DR
Radio Sonic Corp., 186 Union Ave., New Rochelle, N. Y.—DL
Radio Specialty Mfg. Co., 2023 S. E. 6 Ave., Portland 14, Ore.—DA, DE, DF, DJ, DQ, DT
Radio Transceiver Labs., 116-23 Jamaica Ave., Richmond Hill 18, L. I., N. Y.—DJ, DP, DQ, DR, DT
Reeves-Hoffman Corp., 145 Cherry, Carlisle, Pa.—DF
Remler Co., 2101 Bryant St., San Francisco 10, Calif.—DE, DH, DI, DK, DR
Resdel Eng'g Corp., 2351 Riverside Dr., Los Angeles 39, Calif.—DA, DD, DJ, DN, DO, DP, DQ, DR, DT
Reynolds Radio & Engin. Lab., H. B., 219 Stone St., Oneida, N. Y.—DP, DR
Roanwell Corp., 662 Pacific St., B'klyn 17, N. Y.—DI
Robinson Aviation, Inc., Teterboro Air Terminal, Teterboro, N. J.—DS
Rosen Eng'g Products, Raymond, 32 & Walnut Sts., Philadelphia 4, Pa.—DP
Schauer Mfg. Corp., 4500 Alome Ave., Cincinnati 36, Ohio—DL
Schuttig & Co., 9th & Kearny Sts., N. E., Washington 17, D. C.—DA, DE, DL, DO, DQ, DR
Sealtron Co., The, 9701 Reading Rd., Cincinnati 15, Ohio—DL, DO, DP, DQ, DR
Shevers, Inc., Harold, 123 W. 64th St., New York 23, N. Y.—DN, DO, DP, DQ, DT
Shure Brothers, Inc., 225 W. Huron St., Chicago 10, Ill.—DI
Sierra Electronic Corp., 1050 Brittan Ave., San Carlos, Calif.—DL
Simpson Mfg. Co., Mark, 32-28 49 St., Long Island City 3, N. Y.—DH
Snyder Mfg. Co., 22nd & Ontario Sts., Philadelphia 40, Pa.—DA, DB
Sonar Radio Corp., 59 Myrtle Ave., Brooklyn 1, N. Y.—DA, DF, DJ, DL, DO, DP, DQ, DR
Sound Sales & Eng'g Co., 2005 La Branch, Houston 3, Tex.—DH, DI, DK, DQ, DR, DT
Southern Electric & Transmission Co., 3127 Holmes St., Dallas 15, Tex.—DE
Specialty Battery Co., 212 E. Washington Ave., Madison 3, Wis.—DM
Square Root Mfg. Co., 391 Saw Mill River Rd., Yonkers 2, N. Y.—DN
Standard Crystal Co., 400 Armstrong Ave., Kansas City 1, Kans.—DF
Standard Electronics Corp., 285 Emmet St., Newark 5, N. J.—DA, DF, DI, DO, DP, DR
Standard Piezo Co., 265 Pomfret, Carlisle, Pa.—DF
Standard Transformer Corp., 3580 Elston Ave., Chicago 18, Ill.—DR
Steelman Phonograph & Radio Co., 12-30 Anderson Ave., Mt. Vernon, N. Y.—DD
Stelma, Inc., 389 Ludlow St., Stamford, Conn.—DD, DO, DP, DQ, DR, DT
Stephens Mfg. Corp., 8538 Warner Dr., Culver City, Calif.—DI
Stone City Machine, 1206 7th St., Bedford, Ind.—DS
Stromberg-Carlson Co., 1225 Clifford Ave., Rochester, N. Y.—DH
Sylvania Electric Products, 1740 Broadway, New York 19, N. Y.—DD, DQ
Synchromatic Prods., 766 Broadway, Bayonne, N. J.—DG
Taffet Radio & TV Co., 2530 Belmont Ave., New York 58, N. Y.—DN, DT
Tartak-Stolle Electronics, 9870 S. Grand Ave., Los Angeles 37, Calif.—DI
Technical Appliance Corp., 1 Taco St., Sherburne, N. Y.—DA
Tedford Crystal Labs., 4126 Colerain Ave., Cincinnati 23, Ohio—DF
TelAutograph Corp., 16 W. 61st St., New York 23, N. Y.—DE, DH, DL, DM, DO, DP, DQ, DR
Telechrome, Inc., 88 Merrick Rd., Amityville, L. I., N. Y.—DL
Telectro Industries Corp., 35-16 37th St., Long Island City 1, N. Y.—DA, DH, DJ, DK, DS
Telemarine Communications, 536-542 W. 27th St., New York 1, N. Y.—DN, DQ, DR
Teletronic Labs., Inc., 1835 W. Rosecrans Ave., Gardena, Calif.—DL
Telrex, Inc., Asbury Park, N. J.—DA, DR
Todd-Tran Corp., 752 S. Third Ave., Mt. Vernon, N. Y.—DL, DM
Torngren Co., C. W., 236 Pearl St., Somerville 45, Mass.—DA, DN
Transformer Technicians, 2108 N. Cicero Ave., Chicago 39, Ill.—DL, DM
Transitron, Inc., 154 Spring St., New York 12, N. Y.—DN, DQ, DR
Transmitter Equip. Mfg. Co., 345 Hudson St., New York 14, N. Y.—DJ, DL, DN, DO, DP, DQ, DR
Tru-Vue Television Co., 93 Featherbed Lane, Bronx 52, N. Y.—DH, DO, DP
Turner Co., The, 909 17 St., N. E., Cedar Rapids, Iowa—DI
T-V Products Co., 152 Sandford St., Brooklyn 5, N. Y.—DA, DB, DS
U. S. Motors, 584 Nebraska St., Oshkosh, Wis.—DM
U. S. Recording Co., 1121 Vermont Ave., N. W., Washington 5, D. C.—DI, DL
Universal Aviation, 230 Park Ave., New York, N. Y.—DI
Universal Electronics Co., 2012 S. Sepulveda Blvd., Los Angeles 25, Calif.—DL
Universal Microphone Co., 424 Warren Lane, Inglewood 3, Calif.—DI
Utility Electronics Corp., 221 Grand Ave., E. Newark, N. J.—DD, DH, DL, DO, DP, DQ, DR
Valpey Crystal, P. O. Box 325, Holliston, Mass.—DF
Varo Mfg. Co., 1801 Walnut, Garland, Tex.—DL
Vickers Elec. Div., 1815 Locust St., St. Louis, Mo.—DL
Vincent Co., A. W., 107 St. Paul St., Rochester 4, N. Y.—DH
Vokar Corp., 7300 Huron R. Dr., Dexter, Mich.—DJ, DI
Wadsworth Mfg., 509 Balsam, Liverpool, N. Y.—DS
Ward Products Corp., 1523 E. 45th St., Cleveland 3, Ohio—DA, DB
Waveline, Inc., P. O. Box 470, Caldwell, N. J.—DN
Webster Electric Co., 1900 Clark St., Racine, Wis.—DH
Welch Electric Co., 1221 Wade St., Cincinnati 14, Ohio—DC, DE
West Coast Electronics Co., 1601 S. Burlington Ave., Los Angeles 6, Calif.—DO, DP, DQ, DR
Westinghouse Electric Corp., 2519 Wilkens Ave., Baltimore 3, Md.—DL, DP, DR
White & Son, James L., 374 Verona Ave., Newark 4, N. J.—DA
Wilcox Electric Co., 1400 Chestnut St., Kansas City 1, Mo.—DR
Williams Ship Radio Co., 4366 Mentone St., San Diego 7, Calif.—DR
Wincharger Corp., E. 7th at Division, Sioux City 2, Iowa—DM
Wind Turbine Co., E. Market St. & P.R.R., West Chester, Pa.—DA
Workshop Assoc., Endicott St., Norwood, Mass.—DA

5—Tubes & Crystal Devices

Cathode-ray .... EA
Crystal, germanium .... EB
Crystal, miscellaneous .... EC
Crystal probes .... ED
Crystal, silicon .... EF
Iconoscopes .... EG
Image orthicons .... EH
Klystrons .... EI
Magnetrons .... EJ
Photo tubes .... EK
Receiving tubes .... EL
Rectifiers, metallic .... EM
Rectifier tubes .... EN
Special type tubes .... EO
Subminiature tubes .... EP
Thyatrons .... EQ
Transistors .... ER
Transmitting tubes .... ES
Tube clamps .... EU
Voltage regulators .... ET

Accurate Eng'g Co., 2005 Blue Island Ave., Chicago 8, Ill.—EM, EN
Aerolux Light Corp., 653 11th Ave., New York 36, N. Y.—EN, EO, EQ, ET
Aeronautical Radio Mfg. Co., 155 First St., Mineola, N. Y.—EC
American Structural Products Co., P. O. Box 1035, Toledo 1, Ohio—EA, EJ
American Television, Inc., 5050 Broadway, Chicago, Ill.—EA, EQ
Amperex Electronic Corp., 230 Duffy Ave., Hicksville, L. I., N. Y.—EB, EL, EN, EO, EQ, ES, ET

Bassett, Inc., Rex, 1314 N. E. 17 Court, Ft. Lauderdale, Fla.—EC
Bendix Aviation Corp., Red Bank Div., Eatontown, N. J.—EI, EL, EN, EO, ET
Berger Communications, 109-01 72 Rd., Forest Hills, L. I., N. Y.—EA
Berkshire Labs., 586 Beaver Pond Rd., Lincoln, Mass.—EB
Birtcher Corp., The, 4371 Valley Blvd., Los Angeles 32, Calif.—EU
Bogue Railway Equip. Div., 52 Iowa Ave., Paterson 3, N. J.—EM, ET
Bomac Labs., Inc., Salem Rd., Beverly, Mass.—EB, EC, EF, EJ, EQ
Bradley Labs., Inc., 168 Columbus Ave., New Haven 11, Conn.—EK, EM
Breon Labs., 1520 Evergreen, Williamsport, Pa.—EC

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for Broadcasting and Industry

TRANSMITTING AND INDUSTRIAL TUBES

TYPE	CATHODE		MU	MAX. ANODE RATING				FULL INPUT FREQ. MCS.	COOLING
	VOLTS	AMPS		VOLTS	AMPS	INPUT WATTS	DISS. WATTS		
ML-2C39A	6.3	1.0	100	1000	0.125	125	100	2500	Forced-Air
ML-207	22.0	51.0	20	15000	2.0	30000	10000	1.6	Water
ML-212E	14.0	6.0	16	3000	.350	—	275	1.5	Convection
ML-220C	21.5	41.0	40	15000	1.5	—	10000	4	Water
ML-220CA	21.5	41.0	40	15000	1.5	—	5000	4	Forced-Air
ML-228A	21.5	41.0	16	6000	1.5	—	5000	3	Water
ML-232B	20.0	60.0	40	20000	3.0	—	25000	3	Water
ML-240B	21.5	41.0	40	12000	1.7	—	10000	20	Water
ML-241B	14.0	6.0	16	3000	.350	—	275	7.5	Convection
ML-242C	10.0	3.25	12.5	1250	.150	188	100	6	Convection
ML-279A	10.0	21.0	10	3000	.800	—	1200	20	Convection
ML-298A	27	225	32	20000	11.0	—	100000	4	Water
ML-298B	27	225	57.5	20000	11.0	—	100000	4	Water
ML-342A	20.0	67	40	20000	2.5	—	25000	4	Water
ML-343A	21.5	57.5	40	18000	2.0	—	10000	4	Water
ML-343AA	21.5	57.5	40	18000	1.5	—	5000	4	Forced-Air
ML-356	7.5	170	20	12500	6.0	60000	22500	25	Water
ML-357B	10.0	10	30	4000	0.5	1600	400	110	Convection
ML-379A	10.0	21.0	10	3000	.800	—	1200	20	Convection
ML-381	6.3	1.0	100	3500	0.01*	35*	35*	3000	Forced-Air
ML-450TH	7.5	12.0	38	6000	0.6	—	450	40	Convection
ML-805	10.0	3.25	Var.	1500	0.210	315	125	30	Convection
ML-813	10.0	5.0	8.5	2000	0.180	360	100	30	Convection
ML-814	10.0	3.25	—	1250	.150	180	50	30	Convection
ML-833A	10.0	10.0	35	4000	0.50	1800	400	20	Forced-Air
ML-846	11.0	51	40	7500	1.0	7500	2500	50	Water
ML-880	12.6	315	20	10500	6.0	60000	20000	25	Water
ML-889A	11.0	120	21	8500	2.0	16000	5000	50	Water
ML-889RA	11.0	120	21	8500	2.0	16000	5000	40	Forced-Air
ML-891	22.0	60	8.5	12000	2.0	18000	6000	1.6	Water
ML-891R	22.0	60	8.5	10000	2.0	15000	4000	1.6	Forced-Air
ML-892	22.0	60	50	15000	2.0	30000	10000	1.6	Water
ML-892R	22.0	60	50	12500	2.0	18000	4000	1.6	Forced-Air
ML-893A	20.0	183	35	20000	4.0	70000	20000	5	Water
ML-893AR	20.0	183	35	20000	4.0	70000	20000	5	Forced-Air
ML-5530	5.0	55	26	5000	1.75	8750	3000	110	Forced-Air
ML-5541	7.5	57	26	8500	2.75	23000	10000	110	Forced-Air
ML-5604	11.0	176	19.5	12500	3.0	32500	10000	22.5	Forced-Air
ML-5606	22.0	60	50	15000	2.0	30000	10000	1.6	Water
ML-5619	11.0	176	19.5	12500	3.0	32500	20000	22.5	Water
ML-5658	12.0	310	20	12500	5.0	60000	20000	20	Water
ML-5666	11.0	120	21	10000	2.0	20000	12500	22.5	Water
ML-5667	11.0	120	21	10000	2.0	20000	7500	22.5	Forced-Air
ML-5668	22.0	60	50	14000	2.0	28000	20000	5	Water
ML-5669	22.0	60	50	14000	2.0	28000	10000	5	Forced-Air
ML-5681	12.0	220	23	15000	12.0	150000	75000	30	Water
ML-5682	16.5	325	32	16000	20.0	300000	100000	30	Water

*Duty cycle: 0.0033

HIGH-VOLTAGE RECTIFIERS

TYPE	CATHODE		ANODE RATINGS		INSULATION	COOLING
	VOLTS	AMPS	INV. PKV	PEAK AMPS		
ML-102	20	19.0	75	750	Air	Convection
ML-103	10	11.5	125	78	Oil	Convection
ML-106	11	19.0	140	157	Oil	Convection
ML-108	13	12.5	140	200	Oil	Convection
ML-110	10	11.5	140	78	Air	Convection
ML-115	10	11.5	125	100	Air	Convection
ML-120	13	12.5	140	200	Air	Convection
ML-121	10	11.5	140	100	Oil	Convection
ML-126	13	12.5	150	200	Air	Convection
ML-170	13	12.5	200	200	Air	Convection
ML-180	13	12.5	200	200	Oil	Convection
ML-222A	21.5	41	25	5000	Air	Water
ML-5575/100	20	24	150	1000	Air	Convection
ML-5576/200	20	32	150	2500	Air	Convection

MERCURY VAPOR RECTIFIERS

TYPE	CATHODE		TUBE VOLT. DROP	FIL. EXCIT.	COOLING	ANODE RATINGS		
	VOLTS	AMPS				INV. PKV	PEAK AMPS	AV. AMPS
ML-255B	5.0	19	15	Quad	Forced-Air	20	20.0	5.0
ML-266B	5.0	42	15	Quad	Forced-Air	22	40.0	10.0
ML-267B	5.0	6.75	10	Quad.	Convection	7.5	8.0	2.0
ML-315A	5.0	10	15	Quad	Convection	12.5	8.0	2.0
ML-319A	5.0	6.75	10	Quad.	Convection	7.5	8.0	2.0
ML-321A	5.0	10	15	Quad.	Convection	12.5	8.0	2.0
ML-575A	5.0	10	10	In-Ph.	Convection	15	6.0	1.5
ML-673A	5.0	10	10	In-Ph.	Convection	15	6.0	1.5
ML-857B	5.0	30	15	Quad.	Forced-Air	22	40.0	10.0
ML-866A	2.5	5.0	15	In-Ph.	Convection	10	1.0	0.25
ML-869B	5.0	19	15	Quad.	Forced-Air	15	20.0	5.0
ML-872A	5.0	7.5	10	In-Ph	Convection	10	5.0	1.25
ML-8008	5.0	7.5	10	In-Ph.	Convection	10	5.0	1.25

Machlett Electron Tubes are distributed in the United States by Graybar Electric Company, 420 Lexington Avenue, New York 17, N. Y. and in South America, Europe, Asia and Africa by Westrex Corporation, 111 Eighth Avenue, New York 11, N. Y.

Note: For additional technical data or prices, write to Machlett Laboratories, Inc., Springdale, Conn., or contact your nearest Graybar or Westrex office.

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Calvideo Tube Corp., 5232 W. 104 St., Los Angeles 45, Calif.—EA
Capehart-Farnsworth Corp., Ft. Wayne, Ind.—EA, EO
Ceramic Heater Cathode Resistor Co., 20 First St., Keyport, N. J.—EO
Chatham Electronics Corp., 475 Washington St., Newark 2, N. J.—EL, EN, EO, EP, EQ, ES, ET
Colorcraft Mfg. Co., 671 Hope St., Springdale, Conn.—EA, EO
Commercial Radio Monitoring Co., P. O. Box 7037, Kansas City, Mo.—EF
Continental Electric Co., Geneva, Ill.—EA, EN, EO
Cryco, Inc., 1138 Mission, S. Pasadena, Calif.—EC

Dallons Labs., 5066 Santa Monica Blvd., Los Angeles 29, Calif.—EC
De Mornay-Bonardi, Inc., 2223 Burton Ave., Burbank, Calif.—ED
Dittmore & Freimuth Co., 2517 E. Norwich St., Cudahy, Wis.—ED
Dollar Co., Robt., Redwood City, Calif.—EN, EO, ES
Du Mont Labs., A. B., 1500 Main Ave., Clifton, N. J.—EA
D M Radio Products Co., 2300 W. Armitage Ave., Chicago 47, Ill.—EB, EC

Eitel-McCullough, Inc., 798 San Mateo Ave., San Bruno, Calif.—EA, EI, EN, EO, ES
Electronic Devices, Inc., 429 12th St., Brooklyn 11, N. Y.—EM
Electronic Products Co., 111 E. Third St., Mt. Vernon, N. Y.—EO
Electronic Tube Corp., 1200 E. Mermaid Lane, Philadelphia 18, Pa.—EA, EO
Electron-Radar Products, Inc., 1041 N. Pulaski Rd., Chicago 51, Ill.—EB, EC, EK, ER
Electrons, Inc., 127 Sussex, Newark, N. J.—EN, EQ
Eng'g Associates, 434 Patterson Rd., Dayton 9, Ohio—EI, EJ
Equipment & Service Co., 6815 Oriole Dr., Dallas 9, Tex.—EB, EC, EI, EJ, EM, EN, EO, EQ, ES
Eureka Television & Tube Corp., 69 Fifth Ave., Hawthorne, N. J.—EA, EO

Federal Telecommunication Labs., 500 Washington Ave., Nutley 10, N. J.—EO
Freeland Products Co., 700 Dryades St., New Orleans 12, La.—ES

General Electric Co., Schenectady, N. Y.—EA, EB, EC, ED, EG, EH, EI, EJ, EK, EL, EM, EN, EO, EP, EQ, ER, ES, ET
General Electronics, Inc., 101 Hazel St., Paterson, N. J.—EA, EN, EO, EQ, ES
Glasscraft Co., 5210 E. Olympic Blvd., Los Angeles, Calif.—EA
G-V Controls, Inc., 28 Hollywood Plaza, East Orange, N. J.—ET

Haledy Electronics Co., 57 William St., New York 5, N. Y.—EA, EK
Haydu Bros., Box 1226, Plainfield, N. J.—EA
Huggins Labs., 740 Hamilton Ave., Menlo Park, Calif.—EO
Hunt Corp., 453 Lincoln St., Carlisle, Pa.—EC
Hycon Mfg. Co., 2961 E. Colorado St., Pasadena 2, Calif.—EA
Hytron Radio & Electronics Co., 76 Lafayette St., Salem, Mass.—EA, EB, EL, EN, EO, ES, ET

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International Rectifier Corp., 1521 E. Grand Ave., El Segundo, Calif.—EM

Kemtron Electron Products, Inc., 23 Brown St., Salem, Mass.—EB, EF, EO, ER
Kings Microwave Co., 50 Marbledale Ave., Tuckahoe, N. Y.—EI, EJ, ER
Kip Electronics Corp., 155 Waverly Pl., New York 14, N. Y.—EN, EO
Knights Co., James, Sandwich, Ill.—EC
Kotron Rectifier Corp., 54 Clark, Newark, N. J.—EM
Kuthe Labs., Inc., 150 Summit, Newark, N. J.—EQ

Lectrovision, Inc., 144 Union, New Rochelle, N. Y.—EA
Lewis & Kaufman, Inc., 17320 El Rancho Ave., Los Gatos, Calif.—EN, ES
Litton Industries, 1001 E. Britton Ave., San Carlos, Calif.—EJ

Machlett Labs., Inc., 1063 Hope St., Springdale, Conn.—EN, EO, EQ, ES
Mallory & Co., P. R., 3029 E. Washington St., Indianapolis 6, Ind.—EM
Menlo Research Lab., Menlo Park, Calif.—EO
Mercury Electronic, Box 450, Red Bank, N. J.—ET
Microwave Assoc., Inc., 22 Cummington St., Boston 15, Mass.—EB, EC, EF, EJ, ER
Model Rectifier Corp., 557 Rogers Ave., Brooklyn 25, N. Y.—EM
Monitor Products Co., 815 Fremont Ave., S. Pasadena, Calif.—EC
Multi-Tron Lab., 5522 W. Harrison St., Chicago 44, Ill.—EO

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National Union Radio Corp., 350 Scotland Rd., Orange, N. J.—EA, EB, EL, EN, EO, EP, ER, ES, ET
National Video Corp., 3019 W. 47th St., Chicago, Ill.—EA
Nebel Lab., R. E., 1104 Lincoln Pl., B'klyn, N. Y.—EC
North American Phillips Co., 100 E. 42nd St., New York 17, N. Y.—EA, EO

Opad-Green Co., 71 Warren, New York, N. Y.—EM
Orsyd Co., 6602 Walton, Detroit, Mich.—EO, EQ

Pacific Electronics, Shannon Rd., Los Gatos, Calif.—ES
Penta Labs., Inc., 216 N. Milpas St., Santa Barbara, Calif.—EO, EQ, ES
Pioneer Electronics Corp., 24 Saunders St., Salem, Mass.—EO, ET
Precise Development Corp., 999 Long Beach Rd., Oceanside, L. I., N. Y.—ED
Precision Crystal Lab., 2223 Warwick Ave., Santa Monica, Calif.—EC
Process & Instruments, 60 Greenpoint Ave., Brooklyn 22, N. Y.—EO
"Q" Glass Co., 470 Broad St., Bloomfield, N. J.—EA, EI, EJ, EO, EQ, ES

Radiant Lamp Corp., 300 Jeliff, Newark 8, N. J.—EM
Radio Corp. of America, RCA Tube Dept., Harrison, N. J.—EA, ED, EG, EH, EJ, EK, EL, EN, EO, EP, EQ, ES, ET
Radio Receptor Co., 251 W. 19th St., New York 11, N. Y.—EB, EF, EM, ER
Rauland Corp., The, 4245 N. Knox Ave., Chicago 41, Ill.—EA, EQ
Raytheon Mfg. Co., 55 Chapel St., Newton 58, Mass.—EA, EB, EI, EJ, EL, EN, EO, EP, EQ, ER, ES, ET
Reeder & Co., Charles M., 171 Victor Ave., Detroit 3, Mich.—EO
Reeves-Hoffman Corp., 145 Cherry, Carlisle, Pa.—EC
Remington Rand Laboratory, Wilson Ave., S. Norwalk, Conn.—EA
Reynolds Electronics Corp., 507 West St., New York 14, N. Y.—EC, ER
Ross Mfg. Co., 860 Washington St., Burlington, Iowa—EL, EN

Schauer Mfg. Corp., 4500 Alpine Ave., Cincinnati 36, Ohio—EM
Sealtron Co., 9701 Reading Rd., Cincinnati 15, Ohio—EM, ET
Sheldon Electric Co., 76 Coit St., Irvington, N. J.—EA, EQ
Sonotone Corp., Elmsford, N. Y.—EL
Sperry Gyroscope Co., Div. of Sperry Corp., Great Neck, L. I., N. Y.—EI
Standard Arcturus Corp., 54 Clark St., Newark 4, N. J.—EA, EK, EM, EN, EO, ES, ET
Standard Piezo Co., 265 Pomfret, Carlisle, Pa.—EC
Sylvania Elec. Prods., Inc., 1740 Broadway, New York 19, N. Y.—EA, EB, EL, ES

Taffet Radio & TV Co., 2530 Belmont Ave., New York 58, N. Y.—ET
Taylor Tubes, Inc., 2312 Wabansia Ave., Chicago 47, Ill.—EN, EO, EQ, ES
TelAutograph Corp., 16 W. 61, New York, N. Y.—ET
Tel-O-Tube Corp. of America, 180 Van Riper Ave., E. Paterson, N. J.—EA
Thomas Electronics, Inc., 118 9th St., Passaic, N. J.—EA
Tung-Sol Electric Inc., 95 Eighth Ave., Newark 4, N. J.—EA, EK, EL, EN, EO, EP, ER
T. V. Development Corp., 2024 McDonald Ave., Brooklyn 23, N. Y.—EM

United Electronics Co., 42 Spring St., Newark 2, N. J.—EN, EO, EQ, ES
United Technical Labs., Morristown, N. J.—ED
Universal Electronics Co., 2012 S. Sepulveda Blvd., Los Angeles 25, Calif.—ET

Vacuum Tube Products, 506 S. Cleveland St., Oceanside, Calif.—EA, EI, EN, EO, EQ, ES
Valpey Crystal Corp., Holliston, Mass.—EC
Varian Associates, 990 Varian St., San Carlos, Calif.—EI, ES
Varo Mfg. Co., 1801 Walnut St., Garland, Tex.—ET
Vickers Elec. Div., 1815 Locust St., St. Louis, Mo.—EM, ET

Westinghouse Elec. Corp., Elmira, N. Y.—EA

Zetha Television Tubes Inc., 131 Getty Ave., Clifton, N. J.—EA

AND THE WARNING GOES STRAIGHT TO CENTRAL CONTROL

A PACKAGED UNIT—The inexpensive H. & P. system is packaged in a single streamlined housing, and is designed for easy installation and maintenance.

WHAT IT WILL DO—It triggers an alarm signal, via micro-wave, in the event of any light failures. It indicates location, and whether Beacon or obstruction lights (or both) have failed. Also signals power failures in the antenna lighting circuit. Write for complete information, and name of nearest distributor

FCC REGULATIONS REQUIRE either a daily inspection of all tower lights—or the installation of a dependable automatic alarm system to signal light failures. FCC also requires the immediate reporting of all light failures. With stations in difficult terrain, a daily light inspection by personnel is costly. And full compliance is nearly impossible. 24 hours could elapse before discovering a light failure!

HUGHEY & PHILLIPS Automatic Alarm System pays for itself in a few months because personnel inspection costs are virtually eliminated. FCC compliance is assured because all light failures are immediately recorded at the control station.

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Tower Lighting Division
4075 Beverly Boulevard
Los Angeles 4, California

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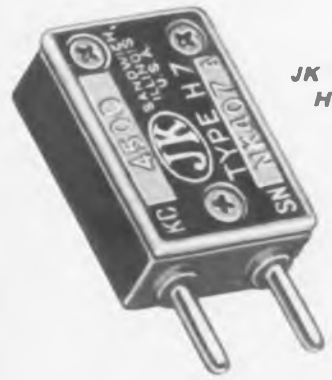
keeping communications ON THE BEAM



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CRYSTALS FOR THE CRITICAL

The H-7 crystal is in common use with two-way police radio systems. Frequency range: 3 to 20 mc. Water and dust-proof, it is pressure mounted, has stainless steel electrodes. Just one of many JK crystals made to serve EVERY crystal need!

FREQUENCY & MODULATION MONITOR

the JK FD-12

Monitors any four frequencies anywhere between 25 mc and 175 mc, checking both frequency deviation and amount of modulation. Keeps the "beam" on allocation, guarantees more solid coverage, too!

Time-Saver to Prowl Cars, Life-Savers to Thousands!

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AMPEREX

AIR-COOLED TUBE AX9904-R/5924

"... Offers a maximum in kilowatts per dollar ..." HARRY R. SMITH, Manager, Television Engineering, Standard Electronics Corporation

STANDARD ELECTRONICS CORPORATION uses this tube in Models TH653 High Band and TL653 Low Band Transmitters and also in their new 20 Kilowatt Transmitter, built on the exclusive S-E ADD-A-UNIT PRINCIPLE, and with special S-E features that insure dependable operation, maximum convenience, and minimum maintenance

STANDARD ELECTRONICS CORPORATION

April 23, 1952

Mr. Sam Norris, Pres.
Amperex Electronics Corp.
25 Washington St.
Brooklyn 1, New York

Dear Mr. Norris:

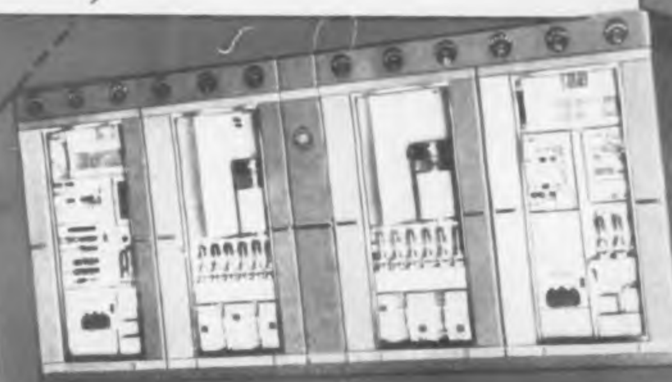
As you know we have been working with the Amperex Type AX9904-R vacuum tube in the development of the various Standard Electronics television broadcast transmitters. The tube is being used in the currently manufactured Model TH653 and TL 653 Transmitters in both the aural and visual sections.

I believe you will be interested in knowing that we are very well satisfied with the performance of this tube as a broad band linear amplifier on all V.H.F. television channels. The low interelectrode capacitance and low internal impedance of the AX9904-R permit power output levels of 5KW and more, with band widths in excess of 5 megacycles. These conditions are readily obtainable from a single tube operating well within its published tube characteristics. The moderate cost of the tube leads us to believe that it offers a maximum in "kilowatts per dollar".

Yours very truly,

Harry R. Smith
Harry R. Smith
Mgr. Television Engineering

HRS:hg



FEATURES INCLUDE ... 14 MC band width at 220 MC ... outputs of 5.7 KW ... thoriated tungsten filament ... non-emitting grid ... disc type grid seal for minimum inductance ... minimum capacitance ... and PROVEN long life.

Write for complete data sheets.

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Years of experience—more than four decades, in fact—have given Blaw-Knox the edge in designing, fabricating and erecting antenna towers for any purpose and any location. Blaw-Knox TV towers are on the job in widely separated geographical areas . . . in wide open fields, atop buildings in crowded cities and even grounded in salt water. Some have TV antennas already mounted—others have built-in provisions for TV when licenses are granted—all are heavily galvanized for longer life.

Whether you need a 100 ft. self-supporting structure or a 1000 ft. guyed tower to meet your requirements—whether for AM, FM, TV or Microwave—write or call today for capable engineering assistance with your plans.

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TRUSCON STEEL TOWERS

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A typical example of Truscon Tower *strength-in-service* is the unit operating for Station WILK-FM, Wyoming Valley Broadcasting Company, Wilkes-Barre, Pennsylvania. The Truscon self-supporting tower is 200 feet high, supports an RCA Two-Section FM Pylon Antenna, and in addition is designed with sufficient strength to support a television antenna in the future.

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Alliance Mfg. Co., Alliance, Ohio—FM
Alpar Mfg. Co., 466 St. Francis St., Redwood City, Calif.—FP, FQ
Alprodco, Inc., Route 2, Box 94, Mineral Wells, Tex.—FP, FQ
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American Electroneering Corp., 5025 W. Jefferson Blvd., Los Angeles 16, Calif.—FN
American Gas Accumulator Co., 1029 Newark Ave., Elizabeth 3, N. J.—FA
American Lava Corp., Chattanooga, Tenn.—FF
American Phenolic Corp., 1830 S. 54 Ave., Chicago 50, Ill.—FM, FR
American Radio Hardware Co., 152 Mac Questen Pkwy. S., Mt. Vernon, N. Y.—FB, FF
Andrew Corp., 363 E. 75 St., Chicago 20, Ill.—FA, FB, FD, FG, FH, FI, FJ, FK, FM, FO, FR
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- COMPLETE—Ready to Assemble
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Vesto Towers are available in a wide range of sizes to meet requirements of amateurs and commercial users alike. Note the low prices for these quality lifetime towers:

22'- $94.75	28'-$115.75
33'-$135.75	39'-$157.75
44'-$178.75	50'-$217.75
61'-$279.75	100'-$1060.00

Towers are shipped to your home knocked down, FOB Kansas City, Mo. 4th class freight. Prices subject to change . . . so order now! Send check or money order . . . or write for free information.

EASY PAYMENTS—Up to 12 Months to Pay

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THE NATION'S FINEST STATIONS CHOOSE LEHIGH TOWERS

- **DEPENDABLE AND DURABLE**
- **YEARS OF DESIGN AND FABRICATING EXPERIENCE**

Lehigh 300 foot tower at WNBW, NBC, Washington, D. C.

- **WE ASSIST IN TOWER PLANNING**

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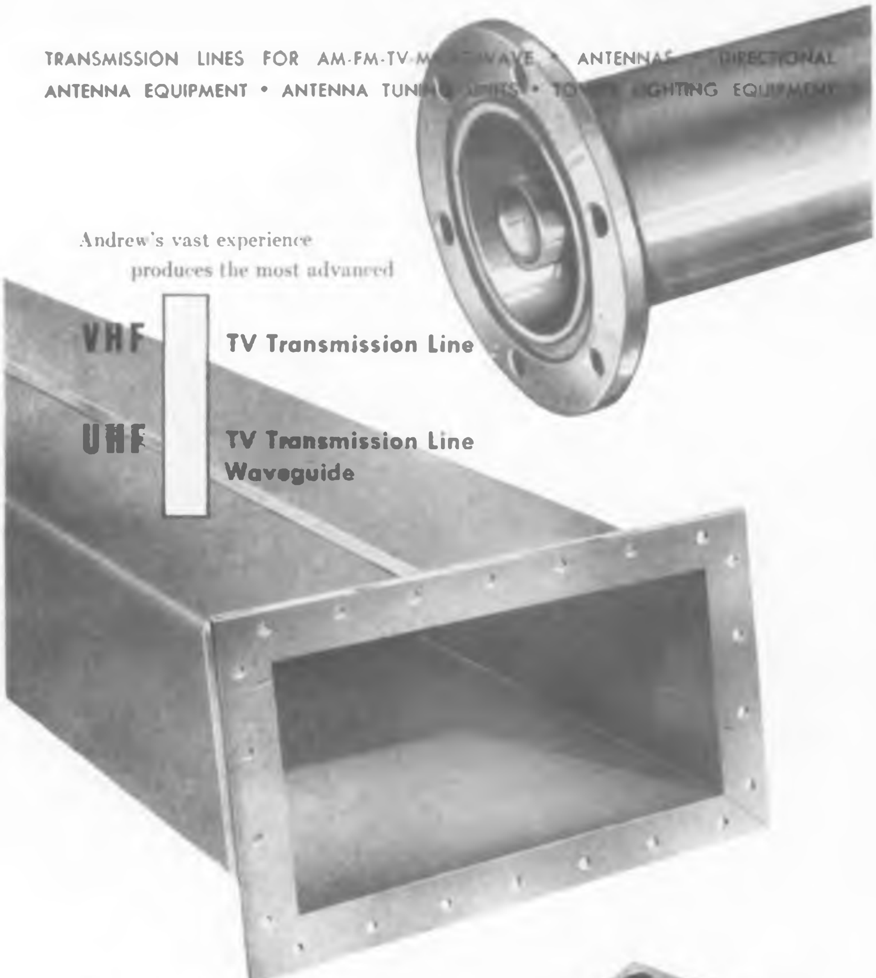

Request Andrew Nomographs in Bulletin 81 for direct graphical computation of efficiency of 10 to 2000 foot runs of line.

Andrew
CORPORATION
363 EAST 75TH STREET, CHICAGO 19
ANTENNA SPECIALISTS

ANDREW Type Number	Size	Impedance	Insulator Bead Material
	TRANSMISSION LINE FOR VHF-TV		
451	1⅝"	51.5 ohms	steatite
551-4	1⅝"	51.5 ohms	Teflon*
452	3⅛"	51.5 ohms	steatite
552-1	3⅛"	51.5 ohms	Teflon*
T-453	6⅛"	51.5 ohms	steatite
	TRANSMISSION LINE FOR UHF-TV		
561	1⅝"	50.0 ohms	Teflon*
562	3⅛"	50.0 ohms	Teflon*
563	6⅛"	75.0 ohms	Teflon*
	WAVEGUIDE FOR UHF-TV		
M-14710	Aluminum 7½" x 15" rectangular cross-section, RTMA designation WR-1500, 12 foot section		
M-14715	Aluminum waveguide WR-1150, 11½" x 5¾" inside dimensions, 12 foot section		

*trademark for DuPont tetrafluoroethylene

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Austin, A. O., Box 109, Barberton, Ohio—FA

Baker Mfg. Co., 183 Enterprise St., Evansville, Wisc.—FB, FQ
Barker & Williamson Inc., 237 Fairfield Ave., Upper Darby, Pa.—FI
Bardwell & McAlister, 2950 N. Ontario St., Burbank Calif.—FB
B. D. N. Steel Erecting Co., 82 W. Washington Blvd., Chicago 2, Ill.—FA, FP, FQ
Birnbach Radio Co., 145 Hudson, New York, N. Y.—FF
Blaw-Knox Div., Blaw-Knox Co., Box 1198, Pittsburgh 30, Pa.—FP, FQ
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit 16, Mich.—FB

Camfield Mfg. Co., 7th St., Grand Haven, Mich.—FD
Centralab, Div. of Globe-Union, Inc., 900 E. Keefe Ave., Milwaukee 1, Wisc.—FF, FO
Clarke Instruments, Div. of National Electrical Machine Shops, Inc., 919 Jesup-Blair Dr., Silver Spring, Md.—FH
Collins Radio Co., 855 35 St. N. E., Cedar Rapids, Iowa—FA, FI, FJ
Communications Co., 300 Greco Ave., Coral Gables 34, Fla.—FI
Continental Electronics Mfg. Co., 4212 S. Bucker Blvd., Dallas 10, Tex.—FB, FD, FG, FI, FL, FN
Co-operative Industries, Inc., 100 Oakdale Rd., Chester, N. J.—FR
Cornell-Dubilier Electric Corp., 333 Hamilton Blvd., S. Plainfield, N. J.—FM
Costelow Co., John A., 125 Kansas Ave., Topeka, Kans.—FP, FQ
Crane Packing Co., 1801 W. Bellepin, Chicago, Ill.—FF
Crouse-Hinds Co., Wolf & T North Sts., Syracuse 1, N. Y.—FA
Crown Controls Co., Inc., 124 S. Washington St., New Bremen, Ohio—FM
Cubic Corp., 2841 Canon St., San Diego 6, Calif.—FC, FD, FE, FH, FK, FN

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Diamond Mfg., 7 North Ave., Wakefield, Mass.—FC
Dittmore & Freimuth Co., 2517 E. Norwich St., Cudahy, Wisc.—FB, FD, FO
Dorne & Margolin, Sheridan Ave., Bethpage, L. I., N. Y.—FC, FJ, FK, FR

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Electrical Tower Service, Creve Coeur, Ill.—FP
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Electronicraft, Inc., 27 Milburn St., Bronxville, N. Y.—FM
Emsco Derrick & Equip. Co., 6811 S. Alameda St., Los Angeles 1, Calif.—FQ
Equipment & Service Co., 6815 Oriole Dr., Dallas 9, Tex.—FF
Engineering Reesarch Associates, Inc., 1902 W. Minnehaha Ave., St. Paul Minn.—FI
Erco Radio Laboratories, Inc., Stewart Ave., Garden City, N. Y.—FB, FE, FO

Federal Telecommunication Labs., Inc., 500 Washington Ave., Nutley 10, N. J.—FC, FD, FK, FN, FS
Fisher-Pierce Co., 170 Pearl St., S. Braintree, Boston 85, Mass.—FU

Garde Mfg. Co., 588 Eddy, Providence, R. I.—FF
Gates Radio Co., 123 Hampshire St., Quincy 1, Ill.—FA, FB, FC, FD, FE, FG, FI, FJ, FK, FM, FS
Gee-Lar Mfg. Co., 1330 10th Ave., Rockford, Ill.—FF
General Cable Corp., 420 Lexington Ave., New York 17, N. Y.—FR
General Communication Co., 681 Beacon St., Boston 15, Mass.—FO
General Electric Co., Electronics Div., Electronics Park, Syracuse, N. Y.—FB, FC, FK, FN, FO, FS
General Electrosonics, Inc., 32 W. 22 St., New York 10, N. Y.—FD
General RF Fittings Co., 702 Beacon St., Boston 15, Mass.—FD, FR
G. W. Associates, Box 2263, EL Segundo, Calif.—FD

Haydon Products Corp., 1801 8 Ave., Brooklyn 15, N. Y.—FF, FP, FQ
Hetherington, Inc., 1200 Elmwood, Sharon Hill, Pa.—FO
Hewlett-Packard Co., 395 Page Mill Rd., Palo Alto, Calif.—FL, FN
Holub Industries, Inc., 413 DeKalb Ave., Sycamore, Ill.—FF
Houghton Laboratories, 322 Bush St., Olean, N. Y.—FF
Hughey & Phillips, 4075 Beverly Blvd., Los Angeles 4, Calif.—FA
Hycon Mfg. Co., 2961 E. Colorado St., Pasadena 8, Calif.—FL, FN

Ideco Div., Dresser-Stacey Co., 875 Michigan Ave., Columbus 8, Ohio—FP, FQ
Imperial Radar & Wire Corp., 4342 Bronx Blvd., Bronx 66, N. Y.—FD, FE, FR
Intervox, 1846 Westlake N., Seattle 9, Wash.—FR
Isolantite Mfg. Corp., Warren Ave., Stirling, N. J.—FF

JFD Mfg. Co., 6127 16 Ave., B'klyn 4, N. Y.—FF
Johnson Co., E. F., Waseca, Minn.—FA, FF, FG, FI, FM, FO, FR
Jones Electronics Co., M. C., 96 N. Main St., Bristol, Conn.—FD, FN

Kay Electric Co., Pine Brook, N. J.—FM
Kirchberger & Co., 1425 37 St., B'klyn 18, N. Y.—FF
Kings Electronics, Inc., 50 Marbledale Ave., Tuckaboe, N. Y.—FI, FR

VEE-D-X
Sectional Tower

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Actual photograph of VEE-D-X Sectional Tower installation showing 152 MC ground-plane antenna ideally suited for ground-to-plane, ship-to-shore, and mobile communications.

THE LaPOINTE-PLASCOMOLD CORP.
ROCKVILLE, CONN.

Kings Microwave Co., 50 Marbledale Ave., Tuckahoe N. Y.—FD FL FN

LaPointe Plascomold Corp., 155 W. Main St., Rockville, Conn.—FB FM. FP FQ
Lapp Insulator Co., Gilbert St., Le Roy, N. Y.—FF
Lehigh Structural Steel Co., 17 Battery Pl., New York 4 N. Y.—FP FQ
Link Radio Corp., 125 W. 17, New York N. Y.—FD
Locke Dept., General Electric Co., P. O. Box 57, Baltimore 3, Md.—FF
Lumenite Electronic Co., 407 S. Dearborn St., Chicago 5, Ill.—FO

Mark Products Co., 3547 Montrose Ave., Chicago 18, Ill.—FD FF FJ FK FM FN FO FR
Mercury E'tronic Co., Box 450, Red Bank, N. J.—FD
Micro Eng'g Corp., 6231 Hollywood Blvd., Hollywood 28 Calif.—FB FR
Microlab, 301 S. Ridgewood Rd., S. Orange, N. J.—FD
Microwave Equipment Co., Caldwell, N. J.—FN FR
Millen Mfg. Co., James, 150 Exchange St., Malden 48 Mass.—FN
Model Engineering & Mfg. Inc., 237 E. Park Dr., Huntington, Ind.—FR
Mueller Electric Co., 1583 E. 31 St., Cleveland 14 Ohio—FF
Mycalex Corp. of America, 180 Clifton Blvd., Clifton, N. J.—FF

Neptune Electronics Co., 433 Broadway, New York 13, N. Y.—FB FO
Network Mfg. Corp., 213 W. 5, Bayonne, N. J.—FD
New England Electrical Works, 365 Main St., Lisbon N. H.—FE
N. R. M. Mfg. & Engineering Co., 4601 W. Addison St. Chicago 41, Ill.—FR

Ohmite Mfg. Co., 4835 W. Flournoy St., Chicago 44, Ill.—FD
Oregon Corvek Co., 1005 N. W. 16 Ave., Portland 9, Ore.—FD

Penn Boiler & Burner Mfg. Corp., Fruitville Rd., Lancaster, Pa.—FP, FQ
Pickard & Burns, 240 Highland Ave., Needham 94 Mass.—FB FJ FK
Polytechnic Research & Development Co., 55 Johnson St., Brooklyn N. Y.—FL FN
Porcelain Products, Inc., Box 830, Parkersburg, W. Va.—FF
Premax Products Div., Chisholm-Fyder Co., Highland & College Aves., Niagara Falls N. Y.—FF
Product Development Co., 307 Bergen Ave., Kearny, N. J.—FR

QRK Electronic Products, 115 N. Circle Dr., Fresno 4, Calif.—FB

Radiart Corp., 3455 Vega, Cleveland 13, Ohio—FM
Radio Corp. of America, RCA-Victor Div., Camden N. J.—FA FB FC FD FF FG FH FI FJ FK FL FM FN FO FP FQ FR FS
Radio Eng'g Labs., Inc., 36-40 37th St., Long Island City 1 N. Y.—FC FI
Radio Essentials, Inc., 152 Mac Questen Pkwy. S. Mt. Vernon N. Y.—FB FP
Radio Sonic Corp., 186 Union Ave., New Rochelle N. Y.—FD
Red Arrow Electronics, Inc., 420 Alden St., Orange N. J.—FJ FK
Resdel Engineering Corp., 2351 Riverside Dr., Los Angeles 39, Calif.—FD FH FI FJ FL FN FS
Rowe Industries, 1702 Wayne, Toledo 9, Ohio—FR FI
Rumph Co., Dave, Box 3178, Ft. Worth, Tex.—FA

Schumaker Constr. Co., Michigan City, Ind.—FB
Schutter Mfg. Co., Carl W., 90 E. Montauk Hwy. Lindenhurst L. I., N. Y.—FC FD FR
Sierra Electronic Corp. 1050 Brittan Ave., San Carlos Calif.—FH FI FI
Skyline Tower Co., 5900 S. Ashland Ave., Chicago 36 Ill.—FQ
Sperry Gyroscope Co., Div. of Sperry Corp., Great Neck L. I., N. Y.—FH FL FN
Square Root Mfg. Co., 391 Saw Mill River Rd. Yonkers 2 N. Y.—FC, FD FI FS
Stainless, Inc., N. Wales Pa.—FP FQ
Standard Electronics Corp., 285 Emmet St., Newark 5 N. J.—FC FI FJ FL FS
STELMA, Inc., 389 Ludlow St., Stamford, Conn.—FC FO
Steward Mfg. Co., D. M., 3600 Jerome Ave., Chattanooga Tenn.—FF
Stupakoff Ceramic & Mfg. Co., Latrobe Pa.—FF, FG
Sunrise Products Co., Box 173 Hawthorne 1, N. J.—FB
Superior Porcelain Co., 931½ Market St., Parkersburg W. Va.—FF
Synthane Corp., 12 River Rd., Oaks, Pa.—FF

Tech Labs. Inc., Bergen & Edsall Blvd., Palisades Park N. J.—FO
Technical Appliance Corp., Sherburne, N. Y.—FN
Technicraft Laboratories, Inc., Thomaston-Waterbury Rd. Thomaston, Conn.—FB FR
TelAutograph Corp., 16 W. 61 New York, N. Y.—FO
Telectro Industries Corp., 35-18 37 St., Long Island City 1 N. Y.—FD FE FO FR
Temco TV Products, 2450 Ramona Blvd., Los Angeles 33 Calif.—FP
Thomas & Sons Co., R., Lisbon, Ohio—FF
Thompson Products, Inc., 2196 Clarkwood Rd., Cleveland 3, Ohio—FD
Thor Ceramics, Inc., 225 Belleville Ave., Bloomfield, N. J.—FF
Time-O-Matic Co., P. O. Box 850, Danville, Ill.—FA
Tower Construction Co., 107 4 St., Sioux City, Iowa FP, FQ

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New telephone: SPring 7-2970

Microwave Assemblies, Radar Components and Precision Instruments . . . manufactured to your Blueprints and Specifications.

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Follow-through is just as important in tower and antenna erection as it is in baseball. Attention to details and to quality are of utmost importance.

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ETS can offer you the finest erection available. Why? Because ETS has experience, backed by hundreds and hundred of satisfied customers. . . . has erected towers for major projects and of major importance. ETS has the equipment and skilled workmen to insure a quality job, done at record speed. . . . is capable of handling every detail of the job from planning to final completion. An enviable record of dependability and integrity are yours when you call. The proof will be gladly given at your request.

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P. O. BOX 1205 — PEORIA, ILL. — PHONE: PEORIA 3-9846

Competent installation and erection of all types towers and antennas.

Tower Sales & Erecting Co., 6100 N E Columbia Blvd, Portland 13, Ore.—FP
Transitron, Inc., 154 Spring, New York, N. Y.—FR
Trio Mfg. Co., Griggsville, Ill.—FL FM
Truscon Steel Co., 1092 Albert St., Youngstown 1, Ohio—FA, FF, FP, FQ

U. S. Engineering Co., 521 Commercial St., Glendale 3, Calif.—FF
Upright Scaffolds Div., 1013 Pardee St., Berkeley 10, Calif.—FQ
Utility Electronics Corp., 231 Grant Ave., E. Newark, N. J.—FR

Vesto Co., 1916 Clay, N. Kansas City, Mo.—FP
Victor Insulators, Inc., Maple Ave., Victor, N. Y.—FF

Wadsworth Mfg. Associates, 509 Balsam St., Liverpool, N. Y.—FR
Waveline Inc., P. O. Box 470, Caldwell, N. J.—FN, FR
Western Gold & Platinum Works, 589 Bryant St., San Francisco, Calif.—FF
Wincharger Corp., E. 7 at Division, Sioux City 2, Iowa—FA, FF, FG, FP, FQ
Wind Turbine Co., E. Market St. & P.R.R., West Chester, Pa.—FA, FE, FF, FM, FO, FP, FQ
Workshop Associates, Div. of Gabriel Co., Endicott St., Norwood, Mass.—FK, FM

7—Studio Transmitter Links & TV Microwave Relay Equipment

Antennas, microwave . . . . GA
Antennas, UHF . . . . GB
Auxiliary equipment . . . . GC
Microwave accessories . . . . GD
Microwave complete relay units . . GE
Radomes . . . . GF
Receivers, studio link . . . . GH
Transmitters . . . . GI

Ainslie Electronic Prods. 312 Quincy Ave., Quincy 69, Mass.—GA
Airtron, Inc., 20 E. Elizabeth Ave., Linden, N. J.—GA, GD
All Channel Antenna, 70-07 Queens Blvd., Woodside 77, N. Y.—GA, GB
American Electroneering, 5025 W. Jefferson Blvd., Los Angeles 16, Calif.—GI
American Phenolic Corp., 1830 S. 54th Ave., Chicago 50, Ill.—GB
Andrew Corp., 363 E. 75th, Chicago, Ill.—GA, GB
Antenna Research Lab., 797 Thomas Lane, Columbus 14, Ohio—GA, GB, GD

Bardwell & McAlister, 2950 N. Ontario St., Burbank, Calif.—GB, GI
Bone Engineering Corp., 701 W. Broadway, Glendale 4, Calif.—GA, GD

Camfield Mfg., 7th St., Grand Haven, Mich.—GB, GF
Century Metalcraft, 14806 Oxnard St., Van Nuys, Calif.—GC
Clarke Instruments, Div. National Electrical Machine Shops, 919 Jesup Blair Drive, Silver Spring, Md.—GH
Communications Devices, 2331 12th Ave., New York 27, N. Y.—GI, GH
Cubic Corp., 2841 Canon St., San Diego 6, Calif.—GA, GB, GC, GD, GE, GI

De Mornay-Bonardi, 3223 Burton Ave., Burbank, Calif.—GD
Diamond Mfg., 7 North Ave., Wakefield, Mass.—GD
Dittmore & Freimuth, 2517 E. Norwich St., Cudahy, Wisc.—GA, GB
Dorne & Margolin, Sheridan Ave., Bethpage, L. I., N. Y.—GA, GB
DuMont Labs., Allen B., 1500 Main Ave., Clifton, N. J.—GA, GB, GC, GD, GE, GH, GI

Electron-Radar Products, 1041 N. Pulaski Rd., Chicago 51, Ill.—GA, GB, GD
Electro Precision Prds., 119-01 22nd Ave., College Point, N. Y.—GA, GB, GD
Emerson & Cuming Co., 126 Massachusetts Ave., Boston 15, Mass.—GA, GD, GE, GF
Erco Radio Labs., Stewart Ave., Garden City, N. Y.—GB

Federal Telecommunication Labs., Inc., 500 Washington Ave., Nutley 10, N. J.—GA, GB, GE, GH, GI
Federal Telecommunication Labs., Inc., 500 Washing
Federal Telephone & Radio, 100 Kingsland Road, Clifton, N. J.—GI

General Electric Co., Electronics Div., Electronics Park, Syracuse, N. Y.—GA, GB, GC, GD, GE, GH, GI
General Precision Lab., 63 Bedford Rd., Pleasantville, N. Y.—GD
G. W. Associates, Box 2263, El Segundo, Calif.—GA, GD

Hammarlund Mfg., 460 W. 34th St., New York 1, N. Y.—GD
Haydon Prods., 1801 8th Ave., Brklyn 15, N. Y.—GB
Hewlett-Packard Co., 395 Page Mill Rd., Palo Alto, Calif.—GD
Hughey & Phillips, 4075 Beverly Blvd., Los Angeles 4, Calif.—GD
Hycon Mfg., 2961 E. Colorado St., Pasadena 8, Calif.—GA, GB, GC, GD, GI
Hy-Lite Antennae, 242 E. 137th, New York, N. Y.—GB

Imperial Radar & Wire, 1342 Bronx Blvd., Bronx 66, N. Y.—GB
International Research Associates, Div. of Iresco, 2221 Warwick Ave., Santa Monica, Calif.—GD, GE, GH, GI

Kellogg Switchboard & Supply, 6650 S. Cicero Ave., Chicago 38, Ill.—GD
Kings Microwave Co., 50 Marbledale Ave., Tuckahoe, N. Y.—GA, GB, GD

Lingo & Son, 2814 Buren Ave., Camden 5, N. J.—GB
Link Radio, 125 W. 17th St., New York 11, N. Y.—GA, GB, GE, GH, GI
Lynch Carrier Systems, Inc., 96 Jessie St., San Francisco 5, Calif.—GC

Magna Electronics, Box 338 Inglewood, Calif.—GB
Mark Products, 3547-49 Montrose Ave., Chicago 18, Ill.—GA, GB, GD, GF
Micro Eng'g Corp., 6233 Hollywood Blvd., Hollywood 28, Calif.—GA, GE
Microlab, 301 S. Ridgewood Rd., So. Orange, N. J.—GD
Microwave Assoc., 22 Cummington St., Boston 15, Mass.—GD

Network Mfg. 213 W. 5th, Bayonne, N. J.—GA, GB
N. R. K. Mfg. & Eng'g. 4601 W. Addison St., Chicago 41, Ill.—GA, GD

Philco Corp., Gov't & Indus. Div., 4700 Wissahickon Ave., Philadelphia 44, Pa.—GA, GC, GD, GE
Philson Mfg., 60-66 Sackett St., B'klyn, N. Y.—GB
Pickard & Burns, 240 Highland Ave., Needham 94, Mass.—GA, GB
Polarad Electronics Corp., 100 Metropolitan Ave., Brooklyn 11, N. Y.—GE
Polytechnic Research & Develop., 55 Johnson St., Brooklyn, N. Y.—GD
Premier Instrument, 52 W. Houston St., New York 12, N. Y.—GD
Product Development, 307 Bergen Ave., Kearny, N. J.—GA, GB, GD

Radio Corp. of America, RCA-Victor Div., Camden, N. J.—GA, GB, GC, GD, GE, GH, GI
Radio Eng'g. Labs., 36-40 37th St., Long Island City 1, N. Y.—GA, GB, GD, GE, GH, GI
Rosen Eng'g. Prods., Raymond, 32 & Walnut Sts., Philadelphia 4, Pa.—GE

Schutter Mfg., Carl W., 80 E. Montauk Highway, Lindenhurst, L. I., N. Y.—GA, GD
Shevers, Inc., Harold, 123 W. 64th St., New York 23, N. Y.—GH
Sierra Electronic Corp., 1050 Brittan Ave., San Carlos, Calif.—GI
Sperry Gyroscope Co., Div. of Sperry Corp., Great Neck, L. I., N. Y.—GD
Square Root Mfg., 391 Saw Mill River Rd., Yonkers 2, N. Y.—GA, GB, GC
Sylvania Electric Prods., 1740 Broadway, New York 19, N. Y.—GC, GD

Technicraft Labs., Thomaston Waterbury Rd., Thomaston, Conn.—GD, GE
TelAutograph Corp., 16 W. 61st St., New York 23, N. Y.—GC, GH, GI
Telechrome, Inc., 88 Merrick Rd., Amityville, L. I., N. Y.—GC, GD, GE, GH, GI
Telemarine Communications Co., 540-542 W. 27th St., New York 1, N. Y.—GI
Telrex, Inc., Asbury Park, N. J.—GA
Torngren Co., C. W., 236 Pearl St., Somerville 45, Mass.—GA, GD
T-V Products, 152 Sandford, Bklyn 5, N. Y.—GB

Vectron, Inc., 235 High St., Waltham, Mass.—GD

Waveline, Inc., P. O. Box 470, Caldwell, N. J.—GA, GD
Weymouth Instrument, 1440 Commercial St., E. Weymouth 89, Mass.—GA, GD
Wheeler Labs., 122 Cutter Mill, Great Neck, N. Y.—GD
White & Son, 374 Verona Ave., Newark, N. J.—GB
Wind Turbine Co., E. Market St. & P.R.R., West Chester, Pa.—GD
Workshop Associates, Div. of Gabriel Co., Endicott St., Norwood, Mass.—GA, GB

ESTIMATED PRODUCTION for YEAR 1952 RADIO and TV RECEIVERS

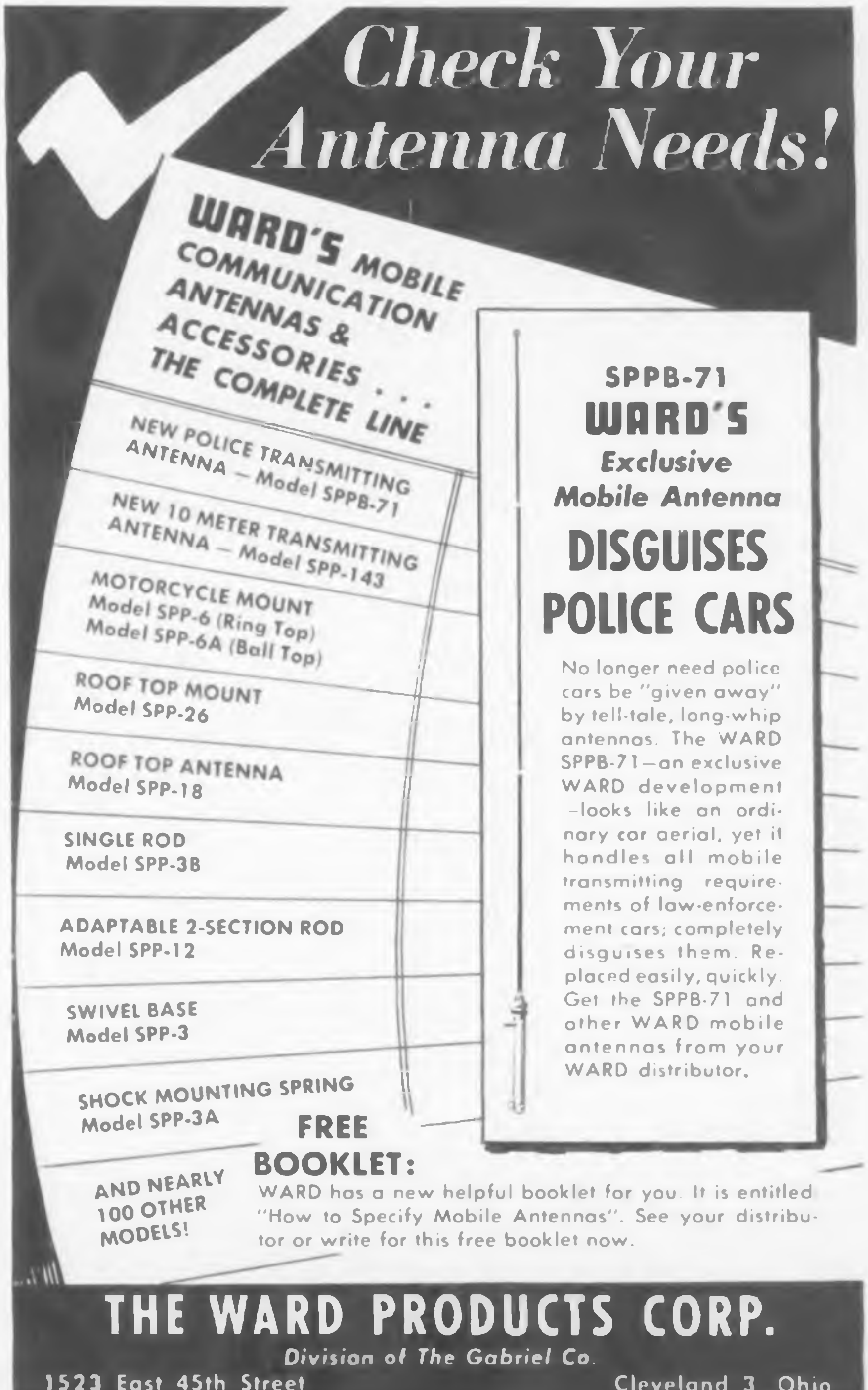
Table radio receivers	5,220,000
Auto radios	4,650,000
Portable radio receivers	1,260,000
Radio-phono combinations	711,000
TOTAL RADIO RECEIVERS	11,841,000
Table & console TV receivers	5,800,000
Combination TV-radio-phono	155,000
TOTAL TV RECEIVERS	5,955,000
TOTAL RADIO and TV RECEIVERS	17,796,000

8—Point-to-Point Microwave Communication Equipment

Antennas	HA
Auxiliary	HB
Complete package	HC
Receiver	HD
Slotted lines	HE
Test equipment	HF
Towers	HG
Transmission line	HH
Transmitter	HI
Wave guide, couplings	HJ
Wave guides, flexible	HK
Wave guides, rigid	HL

Aero Electronics, 1512 N. Wells St., Chicago 10, Ill.—HF
Ainslie Electronic Prods., 312 Quincy Ave., Quincy 69, Mass.—HA
Airtron, Inc., 20 E. Elizabeth Ave., Linden, N. J.—HH, HJ, HK, HL
All Channel Antenna, 70-07 Queens Blvd., Woodside 77, N. Y.—HA, HG
Allied Research & Eng'g., 1041 N. Las Palmas Ave., Hollywood 38, Calif.—HI
Alpar Mfg., 466 St. Francis St., Redwood City, Calif.—HA, HG
Alpha Wire, 430 Broadway, New York, N. Y.—HH
Alpredco, Inc., Rte. 2, Box 94, Mineral Wells, Tex.—HG
American Electroneering, 5025 W. Jefferson Blvd., Los Angeles 16, Calif.—HF
American Phenolic Corp., 1830 S. 54th Ave., Chicago 50, Ill.—HA, HH
Andrew Corp., 363 E. 75th St., Chicago 20, Ill.—HA, HE, HH, HJ, HL
Antenna Research Lab., 797 Thomas Lane, Columbus 14, Ohio—HA, HF
Automatic Electric Co., 1033 W. Van Buren St., Chicago 7, Ill.—HC

Beam Instruments Corp., 350 5th Ave., New York 1, N. Y.—HJ, HK, HL
Blaw-Knox Div., Blaw-Knox Co., P. O. Box 1198, Pittsburgh 30, Pa.—HG
Bone Eng'g Corp., 701 W. Broadway, Glendale 4, Calif.—HE, HF, HI, HL
Budelman Radio, 375 Fairfield Ave., Stamford, Conn.—HA, HD, HI



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WAVEGUIDE

conserves POWER in UHF-TV!

UHF POWER LOSS WITH 3 1/8" COAXIAL TRANSMISSION LINE

Length of Transmission Line	Total Loss	ERP*	Approximate Power Loss
1000 ft.	3 db	50 kw	50 kw
500 ft.	1.5 db	70.7 kw	29.3 kw
100 ft.	0.3 db	93.5 kw	6.5 kw

*Assuming 100 kw ERP with a perfect transmission line

Small increments of attenuation in coaxial transmission lines result in excessive power losses when used in conjunction with hi-gain antennas in the UHF range. This loss of effective radiated power is often as high as 50%.

The best solution to the problem is *waveguide*. Waveguide provides lower attenuation, greater coverage for equal antenna height . . . it can be used in combination with UHF coaxial line . . . requires no dehydration or pressurization.

Prodelin has pioneered the manufacture of copper-clad steel waveguide, and stands ready to assist you in all phases of this important new development. Write for Chart TC-1256, *Attenuation of Coaxial Lines and Waveguide in the UHF Range*, and for information related to your specific needs.

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PRODUCT DEVELOPMENT COMPANY, INC.

307 BERGEN AVENUE KEARNY, NEW JERSEY

Manufacturers of Antennas, Transmission Lines and Associated System Facilities

Calnevar Co., 1732 W. Washington Blvd., Los Angeles 7, Calif.—HF, HJ, HL
Century Metalcraft., 14806 Oxnard St., Van Nuys, Calif.—HF
C.G.S. Labs., 391 Ludlow, Stamford, Conn.—HF
Columbia Technical Corp., 5 E. 57th St., New York 22, N. Y.—HH
Co-Operative Industries, 100 Oakdale Rd., Chester, N. J.—HH, HJ, HK, HL
Cubic Corp., 2841 Canon St., San Diego 6, Calif.—HA, HB, HC, HD, HE, HF, HH, HL

Danbury-Knudsen, Inc., Danbury, Conn.—HJ
De Mornay-Bonardi, Inc., 3223 Burton Ave., Burbank, Calif.—HE, HF, HJ, HL
Diamond Mfg., 7 North Ave., Wakefield, Mass.—HF
Dittmore & Freimuth, 2517 E. Norwich St., Cudahy, Wisc.—HA
Dorne & Margolin, Sheridan Ave., Bethpage, L. I., N. Y.—HA

Edin Co., 207 Main St., Worcester 8, Mass.—HF
Electron-Radar Prods., 1041 N. Pulaski Rd., Chicago 51, Ill.—HA, HF
Electro Precision Prods., 119-01 22nd Ave., College Point, N. Y.—HA, HJ, HL
Electro-Tech Equip., 308 Canal St., New York 13, N. Y.—HF
Electrotechnic Corp., 15601 Arrow Highway, Azusa, Calif.—HC, HD, HI
Elizabeth Iron Works, Box 360, Elizabeth 8, N. J.—HG
Emerson & Cuming, 126 Massachusetts Ave., Boston 15, Mass.—HA, HC
Engineering Associates, 434 Patterson Rd., Dayton 9, Ohio—HE, HF
Equipment & Service Co., 6815 Oriole Dr., Dallas 9, Tex.—HF

Federal Telecommunication Labs., 500 Washington Ave., Nutley 10, N. J.—HA, HC, HD, HE
Flippen Mfg., 132 S. Main St., Orange, Calif.—HJ
Frequency Standards Corp., Box 66, Eatontown, N. J.—HF

General Electric Co., Electronics Div., Electronics Park, Syracuse, N. Y.—HC
General RF Fittings Co., 702 Beacon St., Boston 15, Mass.—HI
G & M Equip. Co., 7315 Varna Ave., North Hollywood, Calif.—HF
G.W. Associates, P. O. Box 2263, El Segundo, Calif.—HA, HE, HF, HJ

Hewlett-Packard Co., 395 Page Mill Rd., Palo Alto, Calif.—HE, HF, HJ
Holub Industries, 413 DeKalb Ave., Sycamore, Ill.—HF

Ideco Div., Dresser-Stacey Co., 875 Michigan Ave., Columbus 8, Ohio—HG
Imperial Radar & Wire Corp., 4342 Bronx Blvd., Bronx 66, N. Y.—HK
International Research Assoc., Div. of Iresco, 2221 Warwick, Santa Monica, Calif.—HC, HD, HF

Korb Engineering & Mfg., 30 Ottawa Ave., Grandville, Mich.—HL
Kay Electric Co., Maple Ave., Pine Brook, N. J.—HE, HF
King Microwave Co., 50 Marbledale Ave., Tuckahoe, N. Y.—HA, HB, HJ, HL

Laboratory for Electronics, 75 Pitts St., Boston 14, Mass.—HF
Lehigh Structural Steel, 17 Battery Place, New York 4, N. Y.—HG
Lenkurt Electric Co., 1105 County Rd., San Carlos, Calif.—HC
Leonard Electric Prods., 67 34th St., Brooklyn 32, N. Y.—HD, HI
Link Radio, 125 W. 17th St., New York 11, N. Y.—HA, HC, HD, HH, HI

Mark Products Co., 3547-49 Montrose Ave., Chicago 18, Ill.—HA, HE, HH, HI, HL
Melpar, Inc., 452 Swann Ave., Alexandria, Va.—HA, HC, HD, HI
Micro Eng'g Corp., 6233 Hollywood Blvd., Hollywood 28, Calif.—HA, HB, HC, HD, HE, HF, HG, HH, HI, HJ, HK, HL
Microlab, 301 S. Ridgewood Rd., S. Orange, N. J.—HF
Microwave Assoc. Inc., 22 Cummington St., Boston 15, Mass.—HF
Millen Mfg., J., 150 Exchange, Malden 48, Mass.—HF
Model Eng'g & Mfg., 237 E. Park Drive, Huntington, Ind.—HJ, HL
Motorola, Inc., 4545 Augusta Blvd., Chicago 51, Ill.—HB, HC, HD, HI

Nichols Prods., 325 W. Main, Moorestown, N. J.—HE
N.R.K. Mfg. & Eng'g Co., 4601 W. Addison St., Chicago 41, Ill.—HA, HH, HJ, HL

Panoramic Radio Prods., 10 S. Second Ave., Mount Vernon, N. Y.—HF
Penn Boiler & Burner Mfg., Lancaster, Pa.—HG
Philco Corp., Gov't & Indus. Div., 4700 Wissahickon Ave., Philadelphia 44, Pa.—HA, HB, HC, HD, HF, HG, HI
Pickard & Burns, 240 Highland, Needham, Mass.—HA
Polytechnic Research & Develop., 55 Johnson St., Brooklyn, N. Y.—HE, HF, HI
Product Develop., 307 Bergen, Kearny, N. J.—HA, HH
Premax Prods. Div., Chisholm-Ryder Co., Highland & College Aves., Niagara Falls, N. Y.—HA

Radio Corp. of America, RCA-Victor Div., Camden, N. J.—HA, HB, HC, HD, HE, HF, HG, HH, HI
Radio Eng'g Labs., Inc., 36-40 37th St., Long Island City 1, N. Y.—HA, HB, HC, HD, HI
Radio Labs. Inc., 1846 Westlake North, Seattle 9, Wash.—HD, HI
Red Arrow Electronics, Inc., 420 Alden St., Orange, N. J.—HJ, HL
Resdel Eng'g Corp., 2351 Riverside Dr., Los Angeles 39, Calif.—HC, HF
Rosen Eng'g Prods., Raymond, 32 & Walnut Sts., Philadelphia 4, Pa.—HC

Schutter Mfg., Carl W., 80 E. Montauk Highway, Lindenhurst, L. I., N. Y.—HE, HF, HH, HJ, HL
Seaboard Electric, 417 Canal, New York, N. Y.—HF

PHILCO

Advanced Design MICROWAVE COMMUNICATIONS SYSTEMS

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Philco *Advanced Design* Microwave Systems are unsurpassed in reliability, performance and economy. They are designed to give you the greatest value for your communications dollar!

Finest quality components, conservatively rated, insure long life and economy of operation and maintenance. Years of production experience enable Philco to produce microwave systems for the lowest possible cost consistent with highest quality.

Philco *Advanced Design* Microwave is flexible. The broadband microwave channel may be divided to carry up to 24 simultaneous 2-way telephone conversations . . . or be further divided for telegraph, teletype, telemetering, signaling or supervisory circuits. Future expansion can be easily accomplished with no loss of original investment.

Philco *Advanced Design* Microwave Systems give you maximum reliability . . . plus *low cost* installation, operation and maintenance. *Don't settle for Less!*

PHILCO CORPORATION

INDUSTRIAL DIVISION

PHILADELPHIA 34, PENNSYLVANIA

Sierra Electronic, 1050 Brittan Ave., San Carlos, Calif —HF, HI
Simpson Electric, 5200 W Kinzie, Chicago, Ill—HI
Southern Elec. & Transmission, 3127 Holmes St., Dallas 15, Tex—HB
Sperry Gyroscope Co., Div. Sperry Corp., Great Neck, L. I., N. Y—HE, HF
Square Root Mfg., 391 Saw Mill River Rd., Yonkers 2, N Y—HJ, HK, HL
Sunrise Prods. Co., Box 173, Hawthorne, N J—HA
Taffett Radio & TV, 2530 Belmont Ave, New York 58, N Y—HF
Technicraft Labs., Inc., Thomaston Waterbury Rd., Thomaston, Conn—HF, HH, HJ, HK, HL
Tektronix, Inc., Box 831, Portland 7, Ore.—HF
TelAutograph Corp., 16 W 61st St., New York 23, N. Y—HB, HD, HF
Telechrome, Inc., 88 Merrick Rd, Amityville, L. I., N Y—HB, HC, HD, HF, HI
Telectro Industries Corp., 35-16 37th St., Long Island City 1, N. Y—HE, HF, HH
Telrex, Inc., Asbury Park, N J—HA
Torngren Co., C. W., 236 Pearl St, Somerville 45, Mass—HA, HJ, HK, HL
Tower Construction Co., 107 4th St, Sioux City, Iowa—HG

Orders Received From U. S. Gov.*

Communication - Electronic Equipment

Jan. 1 - Aug. 27, 1952

COMMUNICATIONS:	
(a) Transmitters	$ 21,857,498.81
(b) Receivers	66,609,874.25
(c) Transceivers	72,225,954.00
Total Communications	160,693,327.06
Radio Navigational Aids	45,423,158.00
Radar	263,131,886.94
Sonar	10,783,479.80
Lab and Test Equipment	13,459,401.71
Piezoelectric Quartz Crystals	**
Miscellaneous	45,296,101.98
Grand Total	$538,794,477.69

* Information supplied by RTMA

** Less than required number of companies reported in this category. Total, however, includes all figures reported.

Transmitter Equip. Mfg., 345 Hudson St, New York 14, N. Y—HD, HI
Transport Prods., Gillespie Airport, Santee, Calif.—HB
Triplett Electrical Instru., Bluffton, Ohio—HF
Troscon Steel Co., Youngstown 1, Ohio—HG
Vectron, Inc., 235 High St., Waltham, Mass—HF
Ward Products Corp., Div. of Gabriel Co., 1523 E. 45th St., Cleveland 3, Ohio—HA
Waveline, Inc., P. O. Box 470, Caldwell, N J—HE, HF, HH, HI, HJ, HK, HL
Westinghouse Electric Corp., 2519 Wilkens Ave, Baltimore 3, Md—HC
White & Son, James L., 374 Verona Ave., Newark 4, N. J—HJ, HL
Wincharger Corp., E. 7th at Division, Sioux City 2, Iowa—HG
Wind Turbine Co., E. Market St. & P.R.R., West Chester, Pa—HG
Workshop Associates, Div. of Gabriel Co., Endicott St., Norwood, Mass—HA, HJ
Yonkers Industries, Subs: Electronic Designs, 28 School St., Yonkers, N. Y—HF

9—*Receivers*

Admiral Corp., 3800 Cortland St., Chicago 47, Ill.—JD, JE, JF
Aeronautical Radio Mfg., 155 First St, Mineola, N. Y.—JC
Air Assoc., 511 Joyce St, Orange, N J.—JB, JC, JG, JH
All Channel Antenna, 70-07 Queens Blvd., Woodside 77, N. Y.—JA
Aloha Radio Television, 330 W Broadway, Long Beach 2, Calif—JD
Altec Lansing, 9356 Santa Monica Blvd, Beverly Hills, Calif—JD, JE
American Electroneering, 5025 W Jefferson Blvd., Los Angeles 16, Calif.—JB, JC, JG, JI, JJ, JK, JL
American Phenolic, 1830 S 54th Ave, Chicago 50, Ill.—JA
American Television, 5050 Broadway, Chicago Ill.—JF
Amy, Aceves & King, 11 W 42 St., New York, N. Y.—JA
Andrea Radio, 27-01 Bridge Plaza N, Long Island City 1, N Y—JD, JE, JF
Ansley Electronics, 85 Tremont St, Meriden, Conn.—JB, JC, JK, JL
ARF Prods., 7627 W Lake St., River Forest, Ill—JB, JL
Arvin Industries, Columbus, Ind—JD, JF
Atlantic Video, 18 Clinton St., B'klyn 2, N. Y.—JA, JD, JE, JF, JM
Audar, Inc., Box 438 M Pasadena, Calif—JD
Automatic Radio Mfg., 122 Brookline Ave, Boston 15, Mass—JD, JE, JF
Baca Television, Green & Lenning Sts., 8 Hackensack, N. J.—JF
Bassett, Inc., Rex, 1314 N E 17 Court, Ft Lauderdale, Fla—JB, JG
Bell Television, 552 W 53rd New York N. Y—JA
Bendix Radio Div., Bendix Aviation Corp., Baltimore 4, Md—JB, JC, JD, JE, JF, JG, JH, JI
Berger Communications, 109-21 72nd St, Forest Hills, L. I., N. Y—JD, JE, JF
Bogen Co., David, 29 9th Ave, New York 12, N. Y.—JD, JE, JG, JL
Brach Mfg., 200 Central Ave, Newark, N. J—JA
Browning Labs, 750 Main, Winchester Mass—JD, JE
Brunswick Div., Radio & Television, Inc., 110 W. 57th St, New York 16, N. Y—JD, JE, JF
Budelman Radio Corp., 375 Fairfield Ave., Stamford, Conn—JG, JH, JJ, JK, JL
Cadillac Electronics, 19 W. 26 St., New York, N Y.—JF
Calnest Eng. & Elec. Co., 828 N. Highland Ave Los Angeles 38, Calif.—JD, JF
Camburn, Inc., 32-40 57th, Woodside, N Y—JA
Capehart-Farnsworth, 3700 Pontiac St., Ft. Wayne 1, Ind—JD, JE, JF
Cardwell Mfg., Allen D., Plainville, Conn.—JM
CBS-Columbia, Inc, 170 53rd St, Brooklyn 32, N. Y.—JD, JE, JF
Certified Radio Labs., 5507 13th Ave., Brooklyn 19, N Y—JF
C.G.S. Labs., 391 Ludlow St., Stamford, Conn.—JB, JC, JG, JH
Channel Master, Napanoch Rd., Ellenville N. Y—JA
Clarke Instruments, 919 Jesup Blair Dr., Silver Spring, Md—JL
Clear Beam TV Antennas, 100 Prospect Ave, Burbank, Calif—JA
Collins Audio Prods., P.O. Box 368, Westfield, N. J.—JD, JE, JL
Collins Radio Co., 855 35th St., N.E., Cedar Rapids, Iowa—JB, JC, JG
Colortronics, Inc., 1311 Riverside Dr, Los Angeles, 31, Calif—JF
Communications Co., 300 Greco Ave., Coral Gables 34, Fla—JB, JC, JG, JH
Communications Devices, 2331 12th Ave., New York 27, N. Y.—JJ, JK
Conrac, Inc., Glendale, Calif.—JF
Cornell-Dubilier Elec., 333 Hamilton Blvd S Plainfield, N. J—JA
Crosby Labs., Box 233, Hicksville, N. Y.—JG, JH
Crosley Div., Avco Mfg., Corp., 1329 Arlington St., Cincinnati 25, Ohio—JD, JE, JF
Cubic Corp., 2841 Canon, San Diego, Calif.—JH
Custom Craft Mfg., 256 E 98th, B'klyn 12 N. Y—JL
Dayton Aviation Radio & Equip., Box 167, Vandalia Ohio—JC
Delco Radio Div., General Motors Corp., Kokomo, Ind—JB, JC, JD, JE, JF, JG, JH
DeWald Radio Mfg. Corp., 35-15 37th Ave., Long Island City, N. Y.—JD, JE, JF
Dittmore & Freimuth Co., 2517 E Norwich St, Cudahy, Wisc—JA, JB, JC
Du Mont Labs., Inc., Allen B., 1500 Main Ave, Clifton, N J—JF, JM
D & R Radio Products Co., 2300 W. Armitage Ave, Chicago 47, Ill—JM
Eckstein Radio & Television Co., 3400 E. 42nd St Minneapolis 6, Minn—JD, JE
Edin Co., 207 Main St, Worcester 8, Mass—JL, JI
Electrotechnic Corp., 15601 Arrow Highway, Azusa, Calif—JB, JC, JG, JH, JI, JJ, JK, JL
Elex Co., The, 69-19 215 St, Bayside, L. I., N. Y—JD, JF
Elm Labs., 18 S. B'dway, Dobbs Ferry, N. Y—JJ
Emerson Radio & Phonograph Corp., 111 Eighth Ave New York 11, N. Y.—JD, JE, JF
Empire Devices, Inc., 38-25 Bell Blvd., Bayside 61, N. Y.—JG
Empire Radio, 125 E 46th St., New York 17, N. Y.—JD, JE, JF
Engineering Associates, 434 Patterson Rd., Dayton 9, Ohio—JC
Equipment & Service Co., 6815 Oriole Dr, Dallas 9, Tex.—JD, JE
Erco Radio Labs., Inc., Stewart Ave, Garden City, N. Y.—JB, JG, JH
Espey Mfg. Co., Inc., 528 E 72 St., New York 21 N Y—JD, JE, JG
Fada Radio & Electric Co., 525 Main St., Belleville, N J—JD, JE, JF
Federal Mfg. & Engineering Corp, 211-217 Steuben St., Brooklyn 5, N. Y.—JG
Ferrar Radio & Television Corp., 55 W. 26 St., New York 10, N. Y.—JD
Finney Co., The, 4612 St Clair Ave., Cleveland 3, Ohio—JA, JC
Fisher Radio Corp., 41 E. 47 St., New York, N. Y.—JD, JE
Franklin Mfg. Corp., 43-20 34 St, Long Island City 1, N Y—JM
Freed Radio Corp., 200 Hudson St, New York 13, N. Y—JD, JE, JF
Functional Music, Inc., 179 N Michigan Ave., Chicago 1, Ill.—JE
Gadgets, Inc., 3629 N. Dixie Dr, Dayton, Ohio—JA, JB
Garod Radio Corp., 70 Washington St., Brooklyn 1, N Y—JD, JE, JF
Gates Radio Co., 123 Hampshire St., Quincy 1, Ill.—JG
General Cement Mfg. Co., 919 Taylor Ave, Rockford Ill.—JA
General Electric Co., Electronics Div., Electronics Park, Syracuse, N. Y.—JD, JE, JF, JI
Gonset Co., 801 S. Main, Burbank, Calif—JH
Grem Engineering, 206 8th Ave., Brooklyn 15, N. Y.—JD, JE, JF
Hallicrafters Co., 4401 W 5th Ave., Chicago, Ill.—JF, JG
Hammarlund Mfg. Co., 460 W 34 St, New York 1, N Y—JB, JG
Harvey-Wells Electronics, Inc., North St., Southbridge, Mass—JB, JC, JI, JJ, JK, JL
Haydon Products Corp., 1801 8 Ave, Brooklyn 15, N. Y—JA
Hoffman Radio Corp., 6200 S Avalon Blvd, Los Angeles 3, Calif—JF
Howard Industries, Inc., 1760 State St., Racine, Wisc.—JI, JJ, JK, JL
Hy-Lite Antennae, Inc., 242 E 137 St., New York 51, N. Y.—JA
Industrial Television, Inc., 369 Lexington Ave, Clifton, N J—JF
Insuline Corp. of America, 36-02 35 Ave, Long Island City 1, N. Y.—JA
International Research Associates, A Div. of Iresco Inc., 2221 Warwick Ave., Santa Monica, Calif—JF, JG
International TV Corp., 238 William St, New York 7, N. Y—JF
Intervox Corp., 1846 Westlake N, Seattle 9, Wash.—JG
Jackson Industries, 58 E. Cullerton St., Chicago 16, Ill—JF
Jarvis Electronic Corp., 6058 W. Fullerton Ave., Chicago 39, Ill—JB, JC
Jewel Radio Corp., 10-40 45th Ave, Long Island City 1 N Y—JD, JE
JFD Mfg. Co., 6127 16th Ave., B'klyn 4, N. Y—JA
Kaye-Halbert Corp., 3555 Hayden Ave., Culver City, Calif—JF
Kay-Townes Antenna Co., Box 586, Rome, Ga—JA
Keeney & Co., J. H., 2600 W 50 St., Chicago 32, Ill—JF
Key Electronics Corp., 20 W 22 St., New York 10 N Y—JD, JE
Kingston Radio Co., Kokomo, Ind—JD, JE
LaPointe Plascomold Corp., The, 155 W Main St., Rockville, Conn.—JA
Leonard Electric Products Co., 67 34 St, Brooklyn 32, N Y—JM
Link Radio Corp., 125 W. 17 St., New York 11, N. Y.—JC, JH, JK
Lion Mfg., 2640 Belmont, Chicago 18, Ill.—JF
Lloyd's Enterprises, Box 313, Altadena, Calif—JD
Magna Electronics Co., 9810 Anza Ave., Box 338, Inglewood, Calif—JA, JD, JE, JI
Magnavox Co., Bueter Rd, Ft Wayne 4, Ind—JD, JE JF
Majestic Radio & Television Corp., 385 4th Ave., New York 16, N. Y.—JD, JE, JF
Mattison Television & Radio Corp., 893 Broadway, New York 3, N. Y—JD, JE, JF
Mark Products Co., 3547-49 Montrose Ave., Chicago 18, Ill—JA
Meck Industries, Plymouth, Ind—JD, JE, JF

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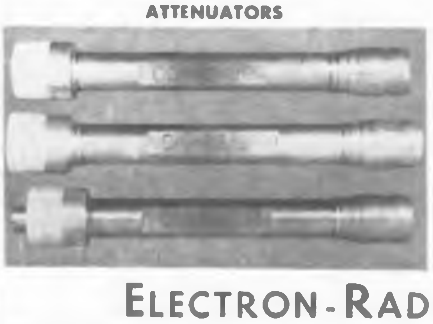

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Motorola, Inc., 4545 W. Augusta Blvd., Chicago, Ill.—JD, JE, JF, JJ, JK
MP Concert Installations, Fairfield, Conn.—JD, JF
Multiple Television Mfg. Co., 987 Heleman Ave., Brooklyn 6, N. Y.—JF
National Co., 61 Sherman St., Malden 48, Mass.—JD, JG, JM
North American Philips Co., Inc., 100 E. 42nd St., New York, N. Y.—JF
Northern Radio Co., 143-147 W. 22 St., New York 11, N. Y.—JG
Northern Radio Co., 314 Bell, Seattle 1, Wash.—JG
Oregon Corvek Co., 1005 N. W. 16 Ave., Portland 9, Ore.—JA
Olympic Radio & Television, Inc., 34-01 38th Ave., Long Island City 1, N. Y.—JD, JE, JF
Pacific Mercury Television Mfg. Corp., 5955 Van Nuys Blvd., Van Nuys, Calif.—JB, JC, JD, JE, JF, JG, JH, JI
Packard-Bell Co., 12333 W. Olympic Blvd., Los Angeles 64, Calif.—JD, JE, JF
Pathe Television Corp., 250 W. 57th St., New York 19, N. Y.—JF
Pearce Simpson, Inc., 3023 Coral Way, Miami 34, Fla.—JG
Peerless TV & Radio Co., 6508 Euclid Ave., Cleveland 3, Ohio—JD, JE, JF
Philco Corp., Tioga & C Sts., Philadelphia, Pa.—JD, JE, JF, JJ, JK
Philharmonic Radio Co., 235 Jersey Ave., New Brunswick, N. J.—JD, JF
Philmore Mfg., 113 University Pl., New York 3, N. Y.—JD, JE
Philson Mfg. Co., 60-66 Sackett St., Brooklyn 31, N. Y.—JA
Pickard & Burns, 240 Highland, Needham, Mass.—JA
Pilot Radio Corp., 37-06 36th St., Long Island City, N. Y.—JD, JE, JF
Radiart Corp., 3455 Vega, Cleveland, Ohio—JA
Radio Apparatus Corp., 55 N. New Jersey St., Indianapolis 4, Ind.—JB, JG, JH
Radio Corp. of America, RCA-Victor Div., Camden, N. J.—JA, JB, JC, JD, JE, JF, JG, JH
Radio Craftsmen Inc., 4401 N. Ravenswood Ave., Chicago 40, Ill.—JD, JE, JF
Radio Engineering Labs., 36-40 37th St., Long Island City 1, N. Y.—JE, JH
Radio Labs., Inc., 1846 Westlake North, Seattle 9, Wash.—JB, JC, JG, JH, JI, JJ, JK, JL
Radiomarine Corp. of America, 75 Varick St., New York 13, N. Y.—JG, JL
Radio Receptor Co., 251 W. 19 St., New York 11, N. Y.—JB, JM
Radio & Television, Inc., 119 W. 57 St., New York 19, N. Y.—JF
Raytheon Television, 5921 W. Dickens Ave., Chicago 39, Ill.—JD, JE, JF, JM
Regal Electronics Corp., 605 W. 130th St., New York, N. Y.—JD, JE, JF
Remler Co., 2101 Bryant St., San Francisco 10, Calif.—JB, JG
Resdel Engineering Corp., 2351 Riverside Dr., Los Angeles 39, Calif.—JB, JC
Roesch Co., D. J., 2200 S. Figueroa St., Los Angeles 7, Calif.—JF
Sargent-Rayment Co., 212 Ninth St., Oakland 7, Calif.—JD, JE
Schott Co., Walter L., 3225 Exposition Pl., Los Angeles 18, Calif.—JA
Scott Radio Labs., 1020 N. Rush St., Chicago 11, Ill.—JD, JE, JF
Semco Eng. & Mfg. Co., 8407 S. Hoover St., Los Angeles 44, Calif.—JF
Sentinel Radio Corp., Evanston, Ill.—JD, JE, JF
Setchell Carlson, Inc., 330 Fifth Ave., New Brighton, Minn.—JD, JE, JF
Shaw Television Corp., 195 Front St., Brooklyn 1, N. Y.—JD, JE, JF
Sheraton Television Corp., 370 7th Ave., New York, N. Y.—JF
Shevers, Inc., Harold, 123 W. 64th St., New York 23, N. Y.—JB, JC, JD, JE, JF, JG, JH, JI, JK, JL, JM
Sightmaster Corp., 111 Cedar St., New Rochelle, N. Y.—JF
Snaider Television, 540 Bushwick, B'klyn, N. Y.—JD
Snyder Mfg. Co., 22nd & Ontario Sts., Philadelphia 40, Pa.—JA
Sonar Radio Corp., 59 Myrtle Ave., Brooklyn 1, N. Y.—JC
Sonora Radio & Television Corp., 2023 W. Carroll, Chicago, Ill.—JD, JE
Sound Labs., 323 E. 48th, New York, N. Y.—JF
Sound Sales & Engineering Co., 2005 La Branch, Houston 3, Tex.—JG, JM
Sparton Radio-Television, Jackson, Mich.—JD, JE, JF
Square Root Mfg. Co., 391 Saw Mill River Rd., Yonkers 2, N. Y.—JA, JC, JE, JF
Standard Coil Products Co., 2329 N. Pulaski Rd., Chicago 39, Ill.—JM
Steelman Phonograph & Radio Co., 12-30 Anderson Ave., Mt. Vernon, N. Y.—JD, JE, JF
Stelma, Inc., 389 Ludlow St., Stamford, Conn.—JB, JG, JH
Stewart-Warner Electric, Div. of Stewart-Warner Corp., 1300 N. Kostner Ave., Chicago 51, Ill.—JD, JE, JF
Stromberg-Carlson Co., 1225 Clifford Ave., Rochester, N. Y.—JD, JE
Sunrise Products Co., P. O. Box 173, Hawthorne 1, N. J.—JA, JC
Sylvania Radio & Television, 254 Rano St., Buffalo 7, N. Y.—JD, JE, JF
Symphonic Radio & Electronic Corp., 292 Main St., Cambridge 42, Mass.—JD
Symphony Radio & Television Corp., 825 W. Pico Blvd., Los Angeles 46, Calif.—JD, JE, JF
Taffet Radio & TV Co., 2530 Belmont Ave., New York 58, N. Y.—JD, JE, JG
Tarzian, Inc., Sarkes, Bloomington, Ind.—JM
Tech-Master Products Co., 443 Broadway, New York 13, N. Y.—JD, JF
Technical Appliance Corp., 1 Taco St., Sherburne, N. Y.—JA
TelAutograph Corp., 16 W. 61 St., New York 23, N. Y.—JG, JH
Tele King Corp., 601 W. 26th St., New York, N. Y.—JD, JE, JF
Telequip Radio Co., 2559 W. 21 St., Chicago 8, Ill.—JF
Teletronic Labs., Inc., 1835 W. Rosecrans Ave., Gardena, Calif.—JB, JC
Telrex, Asbury Park, N. J.—JA, JD, JE, JF, JG, JH
Thordarson-Meissner Mfg., Mt. Carmel, Ill.—JD, JE
Trad Television, Asbury Park, N. J.—JD, JE, JF
Transitron, Inc., 154 Spring St., New York 12, N. Y.—JB, JC
Transmitter Equipment Mfg. Co., 345 Hudson St., New York 14, N. Y.—JB, JC, JG, JH, JI, JJ, JK, JL
Trav-Ler Radio Corp., 571 W. Jackson Blvd., Chicago, Ill.—JD, JE, JF
Trio Mfg. Co., Griggsville, Ill.—JA
Trutone Electronic Eng'g. Co., 812 N. Highland Ave., Los Angeles 38, Calif.—JD
U. S. Television Mfg. Corp., 3 W. 61st St., New York, N. Y.—JD, JE, JF
Universal Major Appliances, Lima, Ohio—JF
Univox Corp., 85 Murray, New York 7, N. Y.—JC
Utility Electronics Corp., 231 Grant Ave., E. Newark, N. J.—JB, JC, JD, JE, JG, JH, JI, JJ, JK, JL
Vidaire Electronics Mfg. Co., 576-80 W. Merrick Rd., Lynbrook, L. I., N. Y.—JF
Ward Products Corp., Div. of The Gabriel Co., 1523 E. 45 St., Cleveland 3, Ohio—JA
Warwick Mfg. Corp., 4640 W. Harrison St., Chicago 44, Ill.—JD, JE, JF
Weingarten Electronic Labs., 7556 Melrose Ave., Los Angeles 46, Calif.—JD
Wells-Gardner & Co., 2701 N. Kildare Ave., Chicago, Ill.—JD, JE, JF
Westinghouse Electric Corp., Television Radio Div., Sunbury, Pa.—JD, JE, JF
White Rock Mfg. Corp., White Rock, S. C.—JD
Wilcox Electric Co., 1400 Chestnut St., Kansas City 1, Mo.—JB, JC, JG
Workshop Associates, The, Div. of The Gabriel Co., Endicott St., Norwood, Mass.—JA
Zenith Radio Corp., 6001 Dickens Ave., Chicago 39, Ill.—JD, JE, JF

10—Color-TV

Adaptors, field sequential	KA
Adaptors, line & dot sequential	KB
Color signal generators	KC
Color tubes	KD
Control equipment	KE
Converters, field sequential	KF
Field cameras	KG
Miscellaneous color accessories	KH
Receivers	KI
Studio cameras	KJ
TV Film cameras	KK

Atlantic Video Corp., 18 Clinton St., Brooklyn 2, N. Y.—KA, KF, KI
Cardwell Mfg. Co., A. D., Plainville, Conn.—KD, KF
CBS-Columbia, Inc., 170 53, B'klyn 32, N. Y.—KI
Celomat Corp., 521 W. 23 St., New York, N. Y.—KD, KF, KH
Colorcraft Mfg. Co., 671 Hope St., Springdale, Conn.—KD
Daven Co., 193 Central Ave., Newark 4, N. J.—KE
DuMont Labs., Inc., Allen B., 1500 Main Ave., Clifton, N. J.—KA, KC, KE, KF, KG, KH, KI, KJ
Eureka Television & Tube Corp., 69 Fifth Ave., Hawthorne, N. J.—KD
Federal Telecommunication Labs., Inc., 500 Washington Ave., Nutley 10, N. J.—KC
Fidelity Tube Corp., 900 Passaic, E. Newark, N. J.—KD
Gray Research & Development Co., 658 Hilliard St., Manchester, Conn.—KI
Imperial Radar & Wire Corp., 4342 Bronx Blvd., Bronx 66, N. Y.—KB
International Research Associates, Div. Iresco, Inc., 2221 Warwick Ave., Santa Monica, Calif.—KA, KB, KF, KH, KI
Kay Electric Co., Maple Ave., Pine Brook, N. J.—KC
Las-Lab, 316 W. Saratoga, Baltimore, Md.—KK
Lumenite Electronic Co., 407 S. Dearborn St., Chicago 5, Ill.—KE
Magnavox Co., Bueter Rd., Ft. Wayne 4, Ind.—KI
Maurer, Inc., J. A., 37-01 31 St., Long Island City 1, N. Y.—KK
Merix Chemical Co., 1021 E. 55, Chicago, Ill.—KH
Micro Eng'g Corp., 6233 Hollywood Blvd., Hollywood 28, Calif.—KA, KB, KC, KD, KE, KF, KG, KH, KI, KJ, KK
Musicolor, Inc., 840 N. Michigan, Chicago, Ill.—KH
Pacific Mercury Television Mfg. Corp., 5955 Van Nuys Blvd., Van Nuys, Calif.—KI
Pioneer Electronics Corp., 24 Saunders St., Salem, Mass.—KH
Rauland Corp., 4245 N. Knox, Chicago, Ill.—KD
Shaw Television Corp., 195 Front, B'klyn, N. Y.—KI
Skiatron Electronics & Television Corp., 30 E. 10 St., New York 3, N. Y.—KE, KI
S.O.S. Cinema Supply Corp., 602 W. 52 St., New York 19, N. Y.—KK
Telechrome, Inc., 88 Merrick Rd., Amityville, L. I., N. Y.—KA, KB, KC, KD, KE, KF, KH, KI, KK
Todd-Tran Corp., 752 S. 3, Mt. Vernon, N. Y.—KE
Universal Aviation Corp., 230 Park Ave., New York, N. Y.—KE
Vacuum Tube Products, 506 S. Cleveland St., Oceanside, Calif.—KD
Vidaire Electronics Mfg. Co., 576-80 W. Merrick Rd., Lynbrook, L. I., N. Y.—KA, KF, KH, KI
Warwick Mfg. Corp., 4640 W. Harrison St., Chicago 44, Ill.—KI
Westinghouse Electric Corp., Television Radio Div., Sunbury, Pa.—KI

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11—Monitors

Antenna phase	LA
Audio	LB
Frequency	LC
Modulation	LD
Service	LE
Video Line	LF
Video off-the-air	LG
Waveform	LH

Altec Lansing Corp., 9356 Santa Monica Blvd., Beverly Hills, Calif.—LB

American Electroneering Corp., 5025 W. Jefferson Blvd., Los Angeles 16, Calif—LA, LD

Andrew Corp., 363 E. 75 St., Chicago 20, Ill.—LA

Atlantic Video Corp., 18 Clinton St., Brooklyn 2, N. Y.—LF, LG

Bardwell & McAlister, 2950 N. Ontario St., Burbank, Calif—LB

Berkeley Scientific Corp., Div. of Beckman Instruments, Inc., 2200 Wright Ave., Richmond, Calif.—LC

Budelman Radio Corp., 375 Fairfield Ave., Stamford, Conn.—LC, LD

Cinema Engineering Co., 1510 W. Verdugo Ave., Burbank, Calif.—LB

Clarke Instruments, 919 Jesup Blair Dr., Silver Spring, Md—LA, LG

Commercial Radio Monitoring Co., P. O. Box 7037, Kansas City, Mo.—LC, LE

Communication Products Co., Marlboro, N. J.—LF

Conn Ltd., C. G., Electronics Div., Jackson Blvd., Elkhart, Ind.—LC

Conrac, Inc., 19217 E. Foothill Blvd., Glendora, Calif.—LF, LG

Doolittle Radio Inc., 7421 Loomis Blvd., Chicago, Ill—LC, LD

DuMont Labs., Inc., Allen B., 1500 Main Ave., Clifton, N. J.—LF, LG, LH

Equipment & Service Co., 6815 Oriole Dr., Dallas 9, Tex.—LB, LC, LD

Federal Telecommunication Labs., Inc., 500 Washington Ave., Nutley 10, N. J.—LC, LD, LF, LG

Gates Radio Co., 123 Hampshire St., Quincy 1, Ill.—LC, LD

General Electric Co., Electronics Div., Electronics Park, Syracuse, N. Y.—LB, LC, LD, LF, LG, LH

General Precision Lab., Inc., 63 Bedford Rd., Pleasantville, N. Y.—LF

General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass.—LC, LD

Hazeltine Electronics Corp., 58-25 Little Neck Pkwy., Little Neck, L. I., N. Y.—LD

Hewlett-Packard Co., 395 Page Mill Rd., Palo Alto, Calif—LB, LC, LD

Imperial Radar & Wire Corp., 4342 Bronx Blvd., Bronx 66, N. Y.—LH

Industrial Television, Inc., 369 Lexington Ave., Clifton, N. J.—LF, LG, LH

International Research Associates, Div. Iresco Inc., 2221 Warwick Ave., Santa Monica, Calif.—LF, LG, LH

King Microwave Co., 50 Marbledale Ave., Tuckahoe, N. Y.—LH

Knights Co., James, Sandwich, Ill.—LC, LD

Langevin Mfg. Corp., 37 W. 65 St., New York 23, N. Y.—LB, LD

Motorola, Inc., 4545 Augusta Blvd., Chicago 51, Ill.—LC, LD

National-Simplex-Bludworth, Inc., 92 Gold St., New York 7, N. Y.—LG

Neptune Electronics Co., 433 Broadway, New York 13, N. Y.—LB, LC, LD

Olesen Co., Otto K., 1534 Cahuenga Blvd., Hollywood 28, Calif.—LB

Pacific Mercury Television Mfg. Corp., 5955 Van Nuys Blvd., Van Nuys, Calif.—LA

Polarad Electronics Corp., 100 Metropolitan Ave., Brooklyn 11, N. Y.—LF, LH

Potter Instrument Co., 115 Cutter Mill Rd., Great Neck, N. Y.—LC

Radio Corp. of America, RCA-Victor Div., Camden, N. J.—LA, LB, LC, LD, LE, LF, LG, LH

Radio-Music Corp., 84 S. Water St., Port Chester, N. Y.—LB

Republic Television, Inc., 7 E. Madison Ave., Dumont, N. J.—LF

Rowe Industries, 1702 Wayne, Toledo 9, Ohio—LB

Sierra Electronic Corp., 1050 Brittan Ave., San Carlos, Calif.—LA

Sperry Gyroscope Co., Div. of Sperry Corp., Great Neck, L. I., N. Y.—LC

Standard Crystal Co., 400 Armstrong Ave., Kansas City 1, Kans.—LE

Standard Electronics Corp., 285 Emmet St., Newark 5, N. J.—LA, LB, LC, LD, LF

Sylvania Electric Products Co., 1740 Broadway, New York, N. Y.—LF, LG, LH

Telechrome Inc., 88 Merrick Rd., Amityville, L. I., N. Y.—LF, LG, LH

Television Utilities Corp., 1315 Jericho Turnpike, New Hyde Park, N. Y.—LE, LF, LG

Torngren Co., C. W., 236 Pearl St., Somerville 45, Mass.—LA

Weymouth Instrument Co., 1440 Commercial St., E. Weymouth 89, Mass.—LC

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50mm	(2")	f3.5 Zeiss Tessar
75mm	(3")	f1.5 Zeiss Biotar
85mm	(3⅜")	f2.8 Steinheil Culminar
90mm	(3½")	f1.8 Angenieux Type P-1
100mm	(4")	f2.8 Meyer Trioplan
135mm	(5¼")	f4.0 Zeiss Triotar
135mm	(5¼")	f4.5 Steinheil Culminar
150mm	(6")	f5.5 Meyer Tele Megor
180mm	(7¼")	f5.5 Meyer Tele Megor
250mm	(10")	f5.5 Meyer Tele Megor
400mm	(16")	f5.5 Meyer Tele Megor

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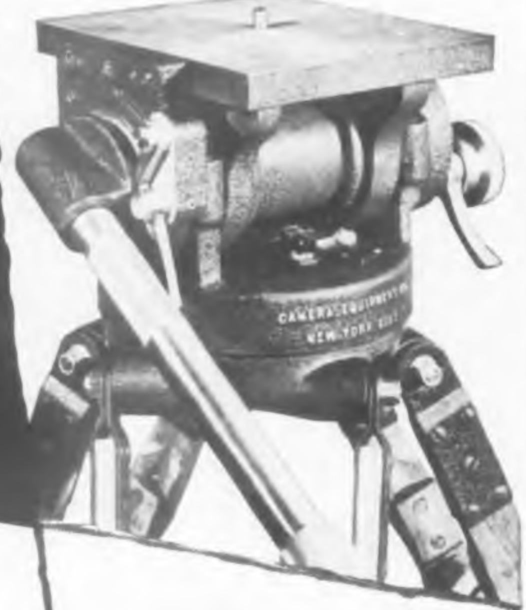

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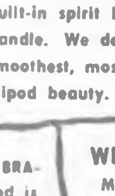

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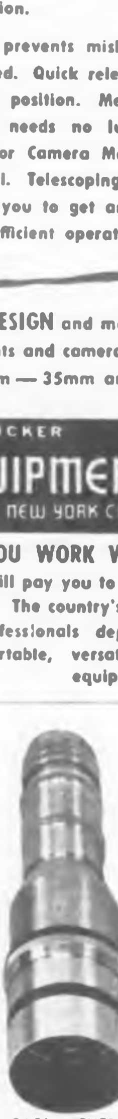

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STUDIO EQUIPMENT

12—Video

Accessories . . . . .MA
Amplifiers, distribution . . . . .MB
Amplifiers, stabilizing . . . . .MC
Attenuators . . . . .MD
Cameras .ME
Camera controls . . . . .MF
Camera cranes . . . . .MG
Camera dollies . . . . .MH
Camera switching systems . . . . . . .MI
Camera turrets . . . . .MJ
Consoles, control . . . . .MK
Consoles, remote switching . . . . . ML
Distribution & mixing equipment . MM
Distribution system, TV, RF . . . . .MN
Flying spot scanner . . . . .MO
Lenses . . . . .MP
Line & program monitors . . . . . . .MQ
Master control . . . . .MR
Montage amplifiers . . . . .MS
Patch cords . . . . .MT
Power supplies . . . . .MU
Projection units . . . . .MV
Special effects equipment . . . . . . .MW
Sync. generators . . . . .MX
Sync. stretchers . . . . .MY
Tripods .MZ
TV film camera . . . . .MAA
TV film camera controls . . . . .MAB
TV Projectors, film . . . . .MAC
TV Projectors, kaleidoscope . . . . .MAD
TV Projectors, mirror multiplexers MAE
TV Projectors, rear screen . . . . . .MAF
TV Projectors, slide . . . . .MAG
TV Projectors, special purpose . . MAH
Video patch panels . . . . .MAI

Accurate Engineering Co., 2005 Blue Island Ave., Chicago 8, Ill.—MU
Acorn Electronics, Box 348, Gibson City, Ill.—MU
Affiliated Photographic Co., 21 W. 45 St., New York 19, N. Y.—MAG
Akeley Camera & Instrument Corp., 345 Hudson St., New York, N. Y.—ME, MF, MG, MH, MI, ML, MP
American Electroneering Corp., 5025 W. Jefferson Blvd., Los Angeles 16, Calif.—MD, MU
American Radio Hardware Co., 152 MacQuesten Pkwy S., Mt. Vernon, N. Y.—MA, MT
American Television, Inc., 5050 Broadway, Chicago, Ill.—MB, MM, MO, MU, MX, MAI
American Television & Radio Co., 300 E. 4 St., St. Paul 1, Minn.—MU
Assoc. Eng'g. Corp. of Boston, 38 Euston Rd., Brighton 35, Mass.—MU
Atlas Sound Corp., 1449 39 St., B'klyn, N. Y.—MZ
Audio Equipment Sales, Div. F. Sumner Hall, Inc., 153 W. 33 St., New York 1, N. Y.—MT, MAI
Bardwell & McAlister, 2950 N. Ontario St., Burbank, Calif.—MB, MU
Bausch & Lomb Optical Co., 628 St. Paul St., Rochester, N. Y.—MP, MAG
Berndt-Bach, Inc., Auricon Div., 7325 Beverly Blvd., Los Angeles 36, Calif.—MAA, MAB
Beta Electric Corp., 333 E. 103 St., New York 29, N. Y.—MU
Bone Engineering Corp., 701 W. Broadway, Glendale 4, Calif.—MK
Booth Co., Arthur E., 4124 Beverly Blvd., Los Angeles 4, Calif.—MU
Buhl Optical Co., 1009 Beech, Pittsburgh, Pa.—MP
Burke & James, 321 S. Wabash, Chicago, Ill.—MP
Camera Equipment Co., 1600 Broadway, New York 19, N. Y.—MH, MP, MZ
Camera Mart, Inc., 1845 Broadway, New York 23, N. Y.—ME, MG, MH, MP, MU, MW, MZ, MAF
Chatham Electronics Corp., 475 Washington St., Newark 2, N. J.—MU
Clarke Instruments, 919 Jesup-Blair Dr., Silver Spring, Md.—MT, MAI
Collins Radio Co., 855 35 St. N. E., Cedar Rapids, Iowa—MK, ML, MT, MU
Compco Corp., 2251 W. St. Paul, Chicago, Ill.—MA
Condenser Products Co., 7517 N. Clark St., Chicago 26, Ill.—MU
Conn. Telephone & Electric, 70 Britannia St., Meriden, Conn.—MT
Conrac, Inc., 19217 E. Foothill Blvd., Glendora, Calif.—MQ
Co-Operative Industries, Inc., 100 Oakdale Rd., Chester, N. J.—MT
Cornell-Dubilier Electric Corp., 333 Hamilton Blvd., S. Plainfield, N. J.—MA, MU
Dage Electronics Corp., 69 N. 2 St., Beech Grove, Ind.—ME, MF, MX
Da-Lite Screen Co., 2711 N. Pulaski Rd., Chicago 39, Ill.—MA, MZ
Daven Co., 193 Central Ave., Newark 4, N. J.—MA, MD, MF, MI, MM, MN
DeVry Corp., 1111 Armitage Ave., Chicago, Ill.—MAC
Dittmore & Freimuth Co., 2517 E. Norwich St., Cudahy, Wisc.—MK, MU
Dorothea Mechanisms, Gale, 81-01 Broadway, Elmhurst, L. I., N. Y.—MV, MW, MAG
DuMont Labs., Inc., Allen B., 1500 Main Ave., Clifton, N. J.—MA, MB, MC, MD, ME, MF, MG, MH, MI, MJ, MK, ML, MM, MN, MO, MP, MQ, MR, MS, MT, MU, MV, MW, MX, MY, MZ, MAA, MAB, MAC, MAE, MAF, MAG, MAH, MAI

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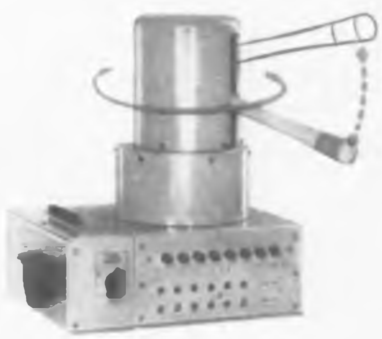

Now, with the GPL Remote Control Pedestal, your cameraman can work at full efficiency a fifth of a mile from his camera ... make any lens or focus adjustment instantly ... control pan and tilt with a pan handle that works as if it were physically attached to the camera ... or, at the touch of a button, swing the camera to any of six pre-set positions, with lens and focus automatically correct. As with all GPL camera chains, the CCU operator has full control of iris setting to assure finest picture reproduction.

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Eagle Electric Mfg. Co., 23-10 Bridge Plaza S., Long Island City 1, N. Y.—MT
Electronic Development Lab., 43-07 23 Ave., Long Island City 5, N. Y.—MA, MB
Electron-Radar Products, Inc., 1041 N. Pulaski Rd., Chicago 51, Ill.—MD
Electro-Tech Equipment Co., 308 Canal St., New York 13 N. Y.—MU
Ercona Camera Corp., 527 Fifth Ave., New York 17, N. Y.—MP
Erwood Inc., 1770 W. Berteau Ave., Chicago 13, Ill. —MB
Federal Telecommunication Labs., Inc., 500 Washington Ave., Nutley 10, N. J.—MA, MB, MC, ME, MF, MG, MH, MI, MK, ML, MM, MN, MO, MP, MQ, MR, MS, MT, MU, MW, MX, MZ, MAA, MAB, MAC, MAI
Ferranti Electric, Inc., 30 Rockefeller Plaza, New York 20, N. Y.—MU
Fish-Shurman Corp., 70 Portman Rd., New Rochelle, N. Y.—MA, ME, MP, MAG
Flett Laboratory, 3711 Marshall Rd., Drexel Hill, Pa. MJ, MO, MP, MV, MW, MAE, MAG, MAH
Furst Electronics, 3322 W. Lawrence Ave., Chicago 25, Ill.—MU
Gates Radio Co., 123 Hampshire St., Quincy 1, Ill. MA, MB, MC, MK, MQ, MR, MT, MW
General Electric Co., Electronics Div., Electronics Park, Syracuse, N. Y.—MA, MB, MC, MD, ME, MF, MH, MI, MJ, MK, ML, MM, MP, MQ, MR, MS, MT, MU, MV, MW, MX, MY, MZ, MAA, MAB, MAC, MAE, MAG, MAI
General Precision Lab., Inc., 63 Bedford Rd., Pleasantville, N. Y.—MA, MB, MC, MD, ME, MF, MG, MH, MI, MJ, MK, ML, MM, MO, MP, MQ, MR, MS, MT, MU, MV, MW, MX, MZ, MAA, MAB, MAC, MAD, MAE, MAF, MAG, MAH, MAI
Georator Corp., 1820 N. Nash, Arlington, Va.—MU
Golde Mfg. Co., 4888 N. Clark St., Chicago 40, Ill. —MAC, MAF, MAG, MAH
Gray Research & Development Co., 658 Hilliard St., Manchester, Conn.—MA, MJ, MV, MAG, MAH
Gulton Mfg. Corp., 212 Durham Ave., Metuchen N. J. MB, MC
Gundlach Mfg. Corp., Fairport, N. Y.—MP
Hart, Arthur H., 2125 32 Ave., San Francisco 16 Calif.—MJ, MP, MV, MAA
Hillyer Instrument Co., 54 Lafayette St., New York 13, N. Y.—MO
Holub Industries, 413 DeKalb Ave., Sycamore, Ill.—MA
Houston-Fearless Corp., 11801 W. Olympic Blvd., W. Los Angeles 64, Calif.—MG, MH, MJ, MK, MZ
Imperial Radar & Wire Corp., 4342 Bronx Blvd., Bronx 66, N. Y.—MA
Industrial Television, Inc., 369 Lexington Ave., Clifton, N. J.—MA, MB, MN
INET Inc., 8655 S. Main, Los Angeles 3, Calif.—MU
International Research Associates, Div. Iresco Inc., 2221 Warwick Ave., Santa Monica, Calif.—MB, MC, MD, MQ, MX, MY
Kepco Laboratories, Inc., 131-38 Sanford Ave., Flushing 55, N. Y.—MU

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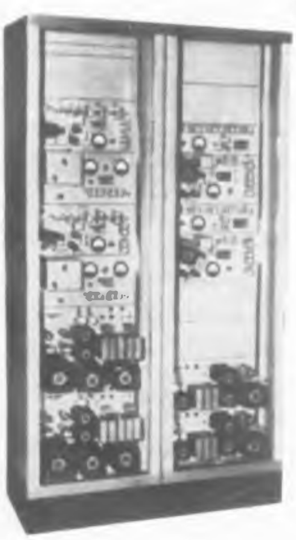

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Lambda Electronics Corp., 103-02 Northern Blvd., Corona 68, N. Y.—MU
Langevin Mfg. Corp., 37 W. 65 St., New York 23, N. Y. —MB, MC, MK, ML, MM, MQ, MR, MS, MU
Las-Lab, 316 W. Saratoga, Baltimore 1, Md.—ME
Libra Film & Equipment, 6525 Sunset Blvd., Hollywood 28, Calif.—MD, MG, MP, MZ
Maurer, Inc., J. A., 37-01 31 St., Long Island City 1, N. Y.—MAA, MAB
Merix Chemical Co., 1021 E. 55 St., Chicago 15, Ill.—MA, MP
Micro Eng'g Corp., 6233 Hollywood Blvd., Hollywood 28, Calif.—MA, MB, MC, MD, ME, MF, MG, MH, MI, MJ, MK, ML, MN, MO, MP, MZ, MAA, MAB, MAC, MAD, MAE, MAF, MAG, MAH, MAI
Millen Mfg. Co., James, 150 Exchange St., Malden 48, Mass.—MU
Mitchell Camera Corp., 666 W. Harvard St., Glendale 4, Calif.—MZ
Movie-Mite Corp., 1105 Truman Rd., Kansas City 6, Mo.—MV
Musicolor, Inc., 840 N. Michigan Ave., Chicago 11, Ill.—MK, MV, MW, MAD, MAE, MAF, MAH
National Cine Equipment, Inc., 209 W. 48 St., New York, N. Y.—MQ, MH
Neptune Electronics Co., 433 Broadway, New York 13, N. Y.—MA, MB, MK, MU
Neutronic Associates, 83-56 Victor Ave., Elmhurst 73, N. Y.—MU
North American Philips Co., Inc., 100 E. 42 St., New York, N. Y.—MV
North Electric Mfg. Co., 501 S. Market St., Galion, Ohio—MK, ML
O'Brien Electric Co., 6514 Santa Monica Blvd., Hollywood 38, Calif.—MA, MK, ML
Opad-Green Co., 71 Warren, New York 7, N. Y.—MU
Parsons Co., Ralph M., 689 S. Fair Oaks Ave., Pasadena 2, Calif.—MB
Pedersen Electronics, Mt. Diablo Blvd., Lafayette, Calif. —MU
Petrick Bros., Inc., 1938 N. Springfield Ave., Chicago 47, Ill.—MZ
Philco Corp., Government & Industrial Div., 4700 Wissahickon Ave., Philadelphia 44, Pa.—MO
Polarad Electronics Corp., 100 Metropolitan Ave., Brooklyn 11, N. Y.—MB, MQ, MU, MX
Ponder & Best, Tele-Lens Div., 814 N. Cole Ave., Hollywood 38, Calif.—MP
Producers Service Co., 2704 W. Olive Ave., Burbank, Calif.—ME
Precision Products, Inc., 719 17 St. N. W., Washington D. C.—ME, MP
Radiant Specialty Co., 1201 S. Talman, Chicago 8, Ill.—MZ
Radio Corp. of America, RCA-Victor Div., Camden, N. J. MA, MB, MC, MD, ME, MF, MG, MH, MI, MJ, MK, ML, MM, MN, MO, MP, MQ, MR, MS, MT, MU, MV, MW, MX, MY, MZ, MAA, MAB, MAC, MAD, MAE, MAF, MAG, MAH, MAI
Radio Essentials, Inc., 152 MacQuesten Pkwy S., Mt. Vernon, N. Y.—MA, MT
Radio Supply & Engineering Co., 85 Selden Ave., Detroit 1, Mich., MA, MB, MC, ME, MI
Republic Lens Co., 916 9 Ave., New York 19, N. Y. —MP
Rowe Industries, 1702 Wayne, Toledo 9, Ohio—MA
Saftee Glass Co., 4717 Stenton Ave., Philadelphia 44, —Pa. MP
Shevers, Inc., Harold, 123 W. 64 St., New York 23, N. Y.—MB, MC, MT, MU
Sierra Electronics Corp., 1050 Brittan Ave., San Carlos, Calif.—MU
Simpson Optical Mfg. Co., 3200 W. Carroll Ave., Chicago 24, Ill.—MP
Skiatron Electronics & Television, 30 E. 10 St., New York, N. Y.—MS, MW
S. O. S. Cinema Supply Corp., 602 W. 52 St., New York 19, N. Y.—MG, MH, MV, MW, MZ, MAA, MAB, MAC, MAF, MAG
Spencer-Kennedy Labs., Inc., 186 Massachusetts Ave., Cambridge 39, Mass.—MB
Standard Electronics Corp., 285 Emmet St., Newark 5, N. J.—MB, MC, MK, ML, MQ, MR, MS, MT, MU, MAI
Strong Electric Corp., 87 City Park Ave., Toledo 2, Ohio—MV, MW
Synchromatic Prods., 766 Broadway, Bayonne, N. J. MV, MW
Taffet Radio & TV Co., 2530 Belmont Ave., New York 58, N. Y.—MT
TelAutograph Corp., 16 W. 61 St., New York 23, N. Y.—MB, MC
Telechrone, Inc., 88 Merrick Rd., Amityville, L. I. N. Y.—MA, MB, MC, MK, ML, MM, MN, MO, MP, MQ, MR, MS, MU, MW, MY, MAG, MAH, MAI
Telefex, 5919 Hollywood Blvd., Hollywood 28, Calif. —MW, MAF, MAG, MAH
Telequip Radio Co., 2559 W. 21 St., Chicago 8, Ill. —MX
Tel-Instrument Co., 50 Paterson Ave., E. Rutherford, N. J.—MM, MX
Todd-Tran Corp., 752 S. 8, Mt. Vernon, N. Y.—MO
Transformer Technicians, Inc., 2608 N. Cicero Ave., Chicago 39, Ill.—MA
Trans-Lux, 1270 6th Ave., New York, N. Y.—MA, MP
Tressel Television Prod., Inc., 2214 E. 75 St., Chicago, Ill.—MAG, MAH
Trimm, Inc., 400 W. Lake St., Libertyville, Ill. —MT, MAI
Tru-Vue Television Co., 99 Featherbed Lane, Bronx 52, N. Y.—MAF, MAH
U. S. Recording Co., 1121 Vermont Ave. N. W., Washington 5, D. C.—MA, MK, MM, MU
Universal Electronics Co., 2012 S. Sepulveda Blvd., Los Angeles 25, Calif.—MU
Victorlite Industries, Inc., 5350 2 Ave., Los Angeles 43, Calif.—MV, MW, MAF, MAH
Vidaire Electronics Mfg. Co., 576-80 W. Merrick Rd., Lynbrook, L. I., N. Y.—MA
Viewlex, Inc., 35-01 Queens Blvd., Long Island City 4, N. Y.—MP
Wenzel Projector Co., 2511 S. State St., Chicago 16, Ill.—MA
Weston Labs., 410 Glen Rd., Weston 93, Mass.—MU
Williams, Brown & Earle, Inc., 918 Chestnut St., Philadelphia 7, Pa.—MP, MV, MAA, MAB, MAC, MAG, MAH
Zenith Optical Laboratory, 1940 Great Neck Rd., Copiague, N. Y.—MP

13—Lighting

Accessories & supplies .... **NA**
Arc lights .... **NB**
Black lights .... **NC**
Control console .... **ND**
Dimmers .... **NE**
Fluorescent .... **NF**
Fluorescent pigment .... **NG**
Gobos .... **NH**
Incandescent .... **NI**
Light meters .... **NJ**
Lighting preset panels .... **NK**
Portable lighting kits .... **NL**
Power supplies .... **NM**
Studio rigging .... **NN**

Ace Electric Mfg. Co., 1458 Shakespear Ave., Bronx 52 N. Y.—NA
Adams Lighting Inc., 48 W. 27th St., New York 1, N. Y.—NF, NI
Adams Electric Co., Frank, 3650 Windsor Pl., St. Louis Mo.—NE
Advance Transformer Co., 1122 W. Catalpa Ave. Chicago 40, Ill.—NA
Aerolux Light Corp., 653 11 Ave., New York 36, N. Y.—NB, NC
Airpax Products Co., Middle River, Baltimore 20, Md.—NM
American Electroneering Corp., 5025 W. Jefferson Blvd., Los Angeles 16, Calif.—NM
Art Specialty Co., 3245 W. Lake St., Chicago 24, Ill.—NA, NF, NI, NL
Atlas Sound Corp., 1449 39 St., Bklyn, N. Y.—NA
Bardwell & McAlister, 2950 N. Ontario St., Burbank, Calif.—NA, NI
Beta Electric Corp., 333 E. 103 St., New York 29 N. Y.—NM
Black Light Products, 67 E. Lake St., Chicago 1 Ill.—NC, NG
Bone Engineering Corp., 701 W. Broadway, Glendale 4 Calif.—NM
Brenkert Light Projection Co., 6545 St. Antoine St., Detroit, Mich.—NI
Burgess Battery Co., Freeport, Ill.—NM
Camera Equipment Co., 1600 Broadway, New York 19, N. Y.—NB, NE, NH, NI, NJ, NL, NM
Camera Mart, Inc., The, 1845 Broadway, New York 23 N. Y.—NH, NJ, NL
Capitol Stage Lighting Co., 527-529 W. 45 St., New York 36, N. Y.—NB, NE, NH, NI, NL
Century Lighting Inc., 521 W. 43 St., New York 36 N. Y.—NA, NC, NF, NG, NI, NN
Comaco Corp., 2251 W. St. Paul Ave., Chicago 47 Ill.—NA, NF, NI
Cornell-Dubilier Electric Corp., 333 Hamilton Blvd., S. Plainfield, N. J.—NM
Curtis Lighting Inc., 6135 W. 65th St., Chicago 38 Ill.—NF, NI
Cutler-Hammer, 411 N. 12th, Milwaukee, Wis.—NE
Dial Light Co. of America Inc., 900 Broadway, New York 3, N. Y.—NE
Dittmore & Freimuth Co., 2517 E. Norwich St., Cudahy, Wis.—NM
Dorothea Mechanisms, Gale, 81-01 Broadway, Elmhurst L. I., N. Y.—NE
Drake Mfg. Co., 1713 Hubbard, Chicago, Ill.—NA
Du Mont Labs., Inc., Allen B., 1500 Main Ave., Clifton, N. J.—NA, NB, NC, ND, NE, NF, NG, NH, NI, NJ, NK, NL, NM, NN
Eagle Electric Mfg. Co., 23-10 Bridge Plaza S., Long Island City 1, N. Y.—NI, NL, NM
Electron-Radar Products, Inc., 1041 N. Pulaski Road Chicago 51, Ill.—NC
Electro-Tech Equipment Co., 308 Canal St., New York 13, N. Y.—NE, NJ
Equipment & Service Co., 6815 Oriole Dr., Dallas 9 Tex.—NA
Ferranti Electric Inc., 30 Rockefeller Plaza, New York 20, N. Y.—NM
Gates Radio Co., 123 Hampshire St., Quincy 1, Ill.—ND, NM
General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass.—NE
Georator Corp., 1820 N. Nash, Arlington, Va.—NM
Golde Mfg. Co., 4888 N. Clark St., Chicago 40 Ill.—NA, NL
Guth Co., Edwin F., 2615 Washington Ave., St. Louis 3 Mo.—NF, NI
Hertner Electric Co., The, 12690 Elmwood Ave. Cleveland 11, Ohio—NM
Holub Industries, 413 Dekalb Ave., Sycamore, Ill.—NA
Houston-Fearless Corp., 11801 W. Olympic Blvd., West Los Angeles 64, Calif.—ND
Howard Industries, 1760 State, Racine, Wis.—NM
Huggins Laboratories, 740 Hamilton Ave., Menlo Park, Calif.—NB
Hughey & Phillips, 4075 Beverly Blvd., Los Angeles 4, Calif.—NA, NL
Imperial Radar & Wire Corp., 4342 Bronx Blvd. Bronx 66, N. Y.—NA
INET, Inc., 8855 S. Main St., Los Angeles 3, Calif.—ND, NM
Int'l Movie Producers Service, 515 Madison Ave., New York 22, N. Y.—NA, NH, NI
Keese Engineering Co., 7358 Santa Monica Blvd., Hollywood 46, Calif.—NC, NF, NG
Kepco Laboratories, Inc., 131-38 Sanford Ave. Flushing 55, N. Y.—NM
Kliegl Bros., 321 W. 50 St., New York 19, N. Y.—NA, NB, NC, ND, NE, NF, NG, NH, NI, NJ, NK, NL, NM, NN
Kelton Electric Mfg. Co., 123 N. J. Railroad Ave. Newark 5, N. J.—NK
Kuthe Laboratories, Inc., 150 Summit St., Newark 4 N. J.—NF
Lee Electric & Mfg. Co., 2806 Clearwater St., Los Angeles 39, Calif.—NM
McColpin-Christie Corp., 3410 W. 67 St., P. O. Box 19665, Los Angeles 43, Calif.—NM
Menlo Research Laboratory, Box 522, Menlo Park Calif.—NC, NF, NG
Merix Chemical Co., 1021 E. 55, Chicago, Ill.—NA
Model Rectifier Corp., 557 Rogers Ave., Brooklyn 25, N. Y.—NM
Mole-Richardson Co., 937 N. Sycamore Ave., Hollywood 38, Calif.—NA, NB, NI, NM
Musicolor, Inc., 840 N. Michigan Ave., Chicago 11—ND, NI
Neptune Electronics Co., 433 Broadway, New York 13, N. Y.—NA, ND, NM
Neutronic Assoc., 83-56 Victor, Elmhurst, N. Y.—NM
North Electric Mfg. Co., 501 S. Market St., Galion, Ohio—ND, NK
Olesen Co., Otto K., 1534 Cahuenga Blvd., Hollywood 28, Calif.—NA, NC, ND, NE, NF, NG, NH, NI, NK, NL, NM
Opad-Green Co., 71 Warren, New York, N. Y.—NM
Photo Research Corp., 127 W. Alameda Ave., Burbank, Calif.—NJ
Photovolt Corp., 95 Madison, New York, N. Y.—NJ
Radio Corporation of America, RCA-Victor Div., Camden, N. J.—NA, NB, NC, ND, NE, NF, NG, NH, NI, NJ, NK, NL, NM, NN
Ready-Power Co., 11231 Freud Ave., Detroit 14, Mich.—NM
Sorensen & Co., 375 Fairfield Ave., Stamford, Conn.—NM
S. O. S. Cinema Supply Corp., 602 W. 52 St., New York, N. Y.—NB, NE, NF, NH, NI, NJ, NK, NL
Standard Electrical Products Co., 400 E. First St., Dayton 2, Ohio—NE
Stroblite Co., 38 W. 52nd St., New York 19, N. Y.—NC, NG
Strong Electric Corp., 87 City Park Ave., Toledo 2, Ohio—NI, NL, NB
Super Electric Products Corp., 46 Oliver St., Newark 4, N. J.—NE
Superior Electric Co., The, 83 Laurel St., Bristol, Conn.—NE
Swank Films, 19 W. 4th, Dayton 2, Ohio—NA, NI
Switzer Bros., 1220 Huron Rd., Cleveland 15, Ohio—NC, NG
Sylvania Electric Products, Inc., 1740 Broadway, New York 19, N. Y.—NC, NF, NG, NI
TelAutograph Corp., 16 W. 61, New York, N. Y.—NM
Todd-Tran Corp., [illegible] S. Third, Mt. Vernon, N. Y.—NM
Tung-Sol Electric Inc., 95 Eighth Ave., Newark 4, N. J.—NI
U. S. Motors Corp., 584 Nebraska St., Oshkosh, Wis.—NM
Uni-Ventions Co., 303 Fifth Ave., New York 16, N. Y.—NM
Universal Electronics Co., [illegible] S. Sepulveda Blvd., Los Angeles 25, Calif.—NM
Vickers Elec. Div., 1815 Locust St., St. Louis, Mo.—NE
Ward Leonard Electric, Mount Vernon, N. Y.—NE
Welch Electric Co., 1221 Wade St., Cincinnati 14, —NI, NM
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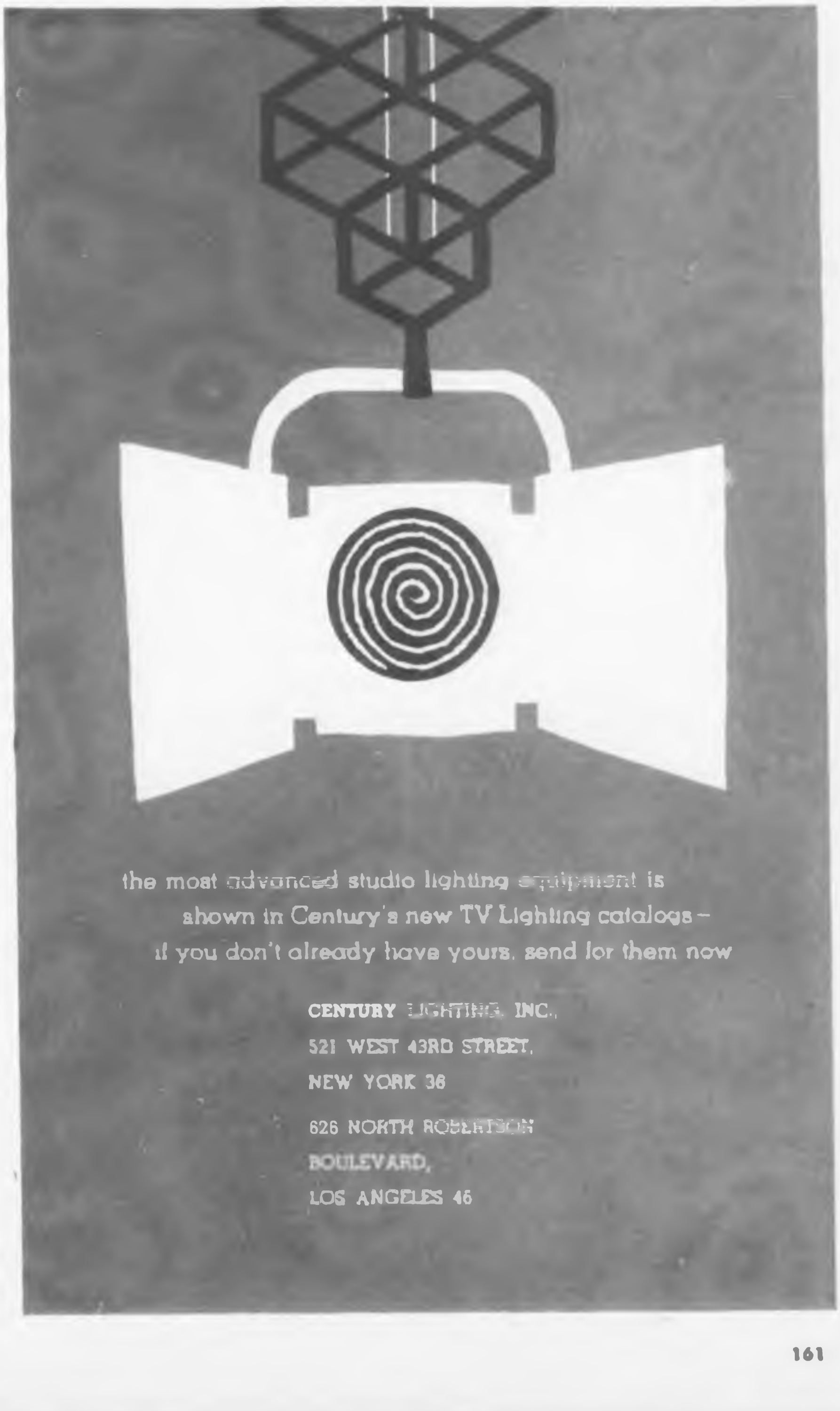

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Film storage	OK
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Lenses	OM
Optical apparatus	ON
Printing	OO
Processing	OP
Projection screens	OQ
Projectors, 16 mm	OR
Projectors, 35 mm	OS
Rear projector	OT
Sound reader	OU
Special effects	OV
Splicing	OW
Theatre TV projectors	OX
Titling	OY
Viewfinders	OZ

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Akeley Camera & Instrument Corp., 345 Hudson St., New York, N. Y.—OA, OD, OE, OH, OM
American Optical Co., Buffalo 15, N. Y.—OM, ON
Ansco Div., General Aniline & Film Corp., Binghamton, N. Y.—OI
Audio & Video Products Corp., 730 Fifth Ave., New York 3, N. Y.—OC, OG, OQ, OR, OT, OV
Baia Motion Picture Engineering, Inc., 120 Victor Ave., Detroit 3, Mich.—OH, OW
Barnes Development Co., 213 W. Baltimore Pike, Lansdowne, Pa.—ON
Bausch & Lomb Optical Co., 635 St. Paul St., Rochester, N. Y.—OM, ON
Beeland Co., Charles D., 324 Walton Bldg., Atlanta 3, Ga.—OA, OH, OR, OW, OY
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Cinematic Development & Cinechrome Lab., 2125 32nd Ave., San Francisco, Calif.—OD, OE, OH, OI, OM, ON, OO, OQ, OU, OV, OW, OY, OZ
Cinetech Co., Inc., 106 West End Ave., New York 23, N. Y.—OD, OE
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Consolidated Production, 540 W. Congress St., Detroit 26, Mich.—OD, OE
Cummins Business Machines Corp., 1740 N. Ravenswood Ave., Chicago 40, Ill.—OG
Da-Lite Screen Co., 2711 N. Pulaski Rd., Chicago 39, Ill.—OC
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Dorothea Mechanisms, Gale, 81 01 Broadway, Elmhurst, L. I., N. Y.—OA
Du Mont Labs., Inc., Allen B., 1500 Main Ave., Clifton, N. J.—OL, OR, OT, OV
Du Pont de Nemours & Co., Inc., E. I., Wilmington, Del.—OI
Eastman Kodak Co., 343 State St., Rochester 4, N. Y.—OD, OE, OH, OI, OJ, OK, OL, OM, ON, OQ
Edix Eng'g. Co., 10495 Scenario Lane, Los Angeles 24, Calif.—OH
EDL Co., 5929 East Dunes Hiway, Gary, Ind.—OH, OO, OP, OU, OV
Electronic Development Lab., 11-07 22 Ave., Long Island City 5, N. Y.—OR, OS, OT
Engineering Devel. Labs., 5929 E. Dunes Highway, Gary, Ind.—OP
Feiler Engineering Co., 8026 Monticello Ave., Skokie, Ill.—OA
Filmack Trailer Corp., 1327 S. Wabash Ave., Chicago 5, Ill.—OA, OH, OP, OV, OY
Film Research Associates, 150 E. 52nd St., New York 22, N. Y.—OF
Fisher Co., O., 1000 N. Division, Peekskill, N. Y.—OP
General Precision Lab., Inc., 63 Bedford Rd., Pleasantville, N. Y.—OL, OP, OR, OS, OT, OX
Golde Mfg. Co., 4888 N. Clark St., Chicago 40, Ill.——OR, OT, OV
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Kin-O-Lux, Inc., 105 W. 40th St., New York 18, N. Y.—OI, OO, OP
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Las-Lab, 316 W. Saratoga St., Baltimore 1, Md.—OD, OE, ON
Lektra Labs., 154 11th Ave., New York, N. Y.—OW
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Peck & Harvey, 5650 N. Western, Chicago, Ill.—OP
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Photo Research Corp., 127 W. Alameda Ave., Burbank, Calif.—OZ
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Precision Products Inc., 719 17th St., N. W. Washington, D. C.—OE, OM, OP
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Audio Equipment Co., 805 Middle Neck Rd., Great Neck, L. I., N. Y.—PAE
Audio Instrument Co., 133 W. 14th St., New York 11, N. Y.—PO, PP, PT, PAB
Audio & Video Products Corp., 730 5 Ave., New York 3, N. Y.—PB, PC, PD, PE, PF, PG, PH, PI, PJ, PK, PL, PM, PN, PO, PP, PR, PS, PT, PU, PV, PW, PX, PZ, PAA, PAB, PAD, PAE, PAF, PAG
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Beam Instruments Corp., 350 5 Ave., New York 1, N. Y.—PH, PQ, PS, PT, PU, PV, PW, PX, PAB
Bell Sound Systems, Inc., 555 Marion Rd., Columbus 7, Ohio—PF, PI, PQ
Berkeley Custom Electronics, 2302 Roosevelt, Berkeley 3, Calif.—PO, PP
Berlant Associates, 4917 W. Jefferson Blvd., Los Angeles 16, Calif.—PE, PH, PI
Berndt-Bach, Inc., Auricon Div., 7325 Beverly Blvd., Los Angeles 36, Calif.—PI, PV, PX, PZ
Bestcraft Products Co., Inc., 626 Broadway, New York 12, N. Y.—PA
Best Mfg. Co., 1200 Grove St., Irvington 11, N. J.—PN
Bogen Co., Inc., David, 29 9 Ave., New York, N. Y.—PD, PE, PF, PJ, PQ, PAB
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...ne Engineering Corp., 701 W. Broadway, Glendale 4, Calif.—PL, PM, PO, PQ, PAA, PAB, PAE, PAF
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M—150-250 ohms	59.5 db below 1 Milliwatt per 10 microbar signal
H—High	57.0 db below 1 volt per microbar

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Burgess Battery Co., Freeport, Ill.—PAA
Burnell & Co., 45 Warburton Ave., Yonkers 2, N. Y.—PO, PP

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Camfield Mfg. Co., 7 St., Grand Haven, Mich.—PK
Cannon Co., C. F., Springwater, N. Y.—PN
Centralab, Div. Globe-Union, Inc., 900 E. Keefe Ave., Milwaukee 1, Wisc.—PD, PAB
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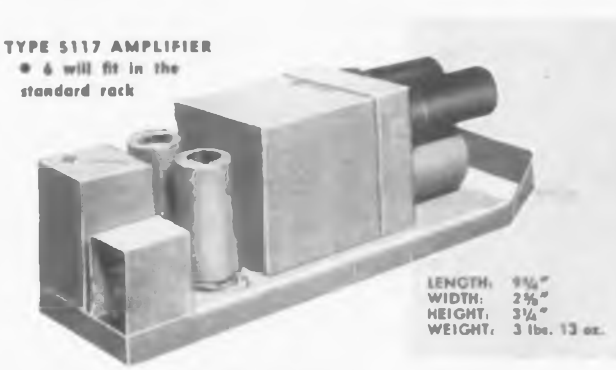

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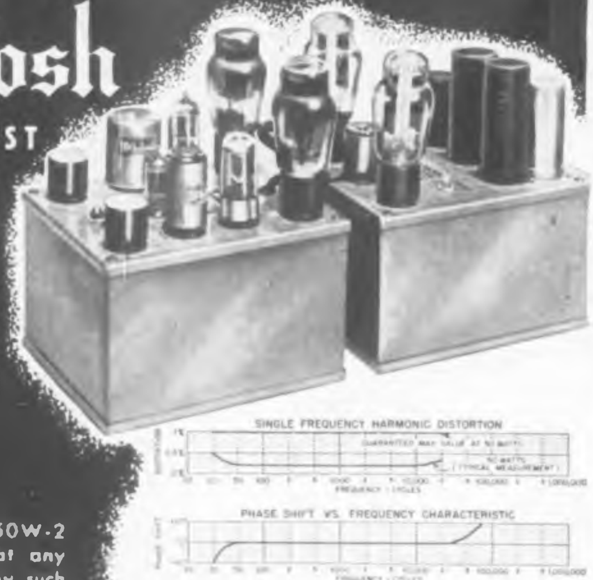

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Transmitter Equipment Mfg. Co., 345 Hudson St., New York 14, N. Y.—PB, PC, PD, PE, PF, PH, PI, PJ, PL, PAA, PAB
Trimm, Inc., 400 W. Lake St., Libertyville, Ill.—PN, PR
Tru-Vue Television Co., 00 Featherbed Lane, Bronx 52, N. Y.—PI, PJ, PQ, PAA
Turner Co., The, 909 17 St., N. E., Cedar Rapids, Iowa—PS, PU, PV, PW, PX
U. S. Recording Co., 1121 Vermont Ave., N. W., Washington 5, D. C.—PA, PB, PC, PD, PE, PF, PG, PH, PI, PJ, JL, PM, PS, PT, PU, PV, PW, PX, PY, PZ, PAA, PAB, PAD, PAF
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Universal Aviation Corp., 230 Park Ave., New York 17, N. Y.—PL, PM
Universal Microphone Co., 424 Warren Lane, Inglewood 1, Calif.—PS, PU, PV, PW, PX, PZ
Valco Mfg. Co., 4700 W. Walton, Chicago, Ill.—PW
Varo Mfg. Co., 1801 Walnut, Garland, Tex.—PAA
Vincent Co., A. W., 163 St. Paul St., Rochester 4, N. Y.—PQ, PAG
Vocaline Co. of America, Inc., Coulter St., Old Saybrook, Conn.—PQ
Vokar Corp., 7300 Huron River Dr., Dexter, Mich.—PP, PR
Wadsworth Mfg. Associates, 509 Balsam St., Liverpool, N. Y.—PR
Waveforms, Inc., 333 Sixth Ave., New York 14, N. Y.—PF, PAB
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Welch Electric Co., 1221 Wade St., Cincinnati 14, Ohio—PB, PC, PD, PE, PF, PG, PH, PI, PJ, PAA, PAB
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FIELD EQUIPMENT

16—Remote Pickup-Video

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Sync. generators .... **QK**
Tripods .... **QL**
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Acorn Electronics, Box 348, Gibson City, Ill.—QJ
Ainslie Electronic Products, Inc., 312 Quincy Ave., Quincy 69, Mass.—QB
Akeley Camera & Instrument Corp., 345 Hudson St., New York, N. Y.—QC, QD, QE, QG, QL
All Channel Antenna Corp., 70-07 Queens Blvd., Woodside 77, N. Y.—QB
Allied Research & Engineering, Inc., 1041 N. Las Palmas Ave., Hollywood 38, Calif.—QM
Alpar Mfg. Co., 466 St. Francis St., Redwood City, Calif.—QB
American Electroneering Corp., 5025 W. Jefferson Blvd., Los Angeles 16, Calif.—QB, QJ
American Television, Inc., 5050 Broadway, Chicago, Ill.—QD, QJ, QK
American Television & Radio Co., 300 E. 4th St., St. Paul 1, Minn.—QJ
Andrew Corp., 363 E. 75th St., Chicago, Ill.—QB
Ansley Electronics, Inc., 85 Tremont St., Meriden, Conn.—QH, QI
Antenna Research Lab., Inc., 797 Thomas Lane, Columbus 14, Ohio—QB
Bausch & Lomb Optical Co., 628 St. Paul St., Rochester, N. Y.—QG
Berndt-Bach, Inc., Auricon Div., 7325 Beverly Blvd., Los Angeles 36, Calif.—QE, QL
Bogue Railway Equipment Div., 52 Iowa Ave., Paterson 5, N. J.—QJ
Bone Engineering Corp., 701 W. Broadway, Glendale 4, Calif.—QM
Buhl Optical Co., 1009 Beech Ave., Pittsburgh 12, Pa.—QG
Burgess Battery Co., Freeport, Ill.—QJ
Burke & James, Inc., 321 So. Wabash Ave., Chicago 4, Ill.—QG
Camburn, Inc., 32-40 57 St., Woodside, N. Y.—QB
Camera Equipment Co., 1600 Broadway, New York 19, N. Y.—QE, QG, QL
Camera Mart Inc., The, 1845 Broadway, New York 23, N. Y.—QE, QF, QJ, QL
Communication Products Co., Marlboro, N. J.—QB
Co-Operative Industries, Inc., 100 Oakdale Rd., Chester, N. J.—QM
Cornell-Dubilier Electric Corp., 333 Hamilton Blvd., S. Plainfield, N. J.—QB, QJ
Cubic Corp., 2841 Canon St., San Diego 6, Calif.—QB, QH, QI, QJ, QM
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Electro Precision Products, Inc., 119-01 22nd Ave., College Point, N. Y.—QM
Erco Radio Laboratories, Inc., Stewart Ave., Garden City, N. Y.—QB
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Ferranti Electric, Inc., 30 Rockefeller Plaza, New York 20, N. Y.—QJ
Fluke Engineering Co., John, Box 755, Springdale, Conn.—QJ
General Electric Co., Electronics Div., Electronics Park, Syracuse, N. Y.—QA, QB, QC, QD, QE, QF, QG, QH, QI, QJ, QK, QL, QM
General Precision Lab., Inc., 63 Bedford Rd., Pleasantville, N. Y.—QC, QD, QE, QF, QG, QJ, QK, QL
Gundlach Mfg. Corp., Fairport, N. Y.—QG
G. W. Associates, P. O. Box 2263, El Segundo, Calif.—QH, QI
Hart, Arthur H., 2125 32 Ave., San Francisco 16, Calif.—QG, QL
Holub Industries, Inc., 413 DeKalb Ave., Sycamore, Ill.—QA
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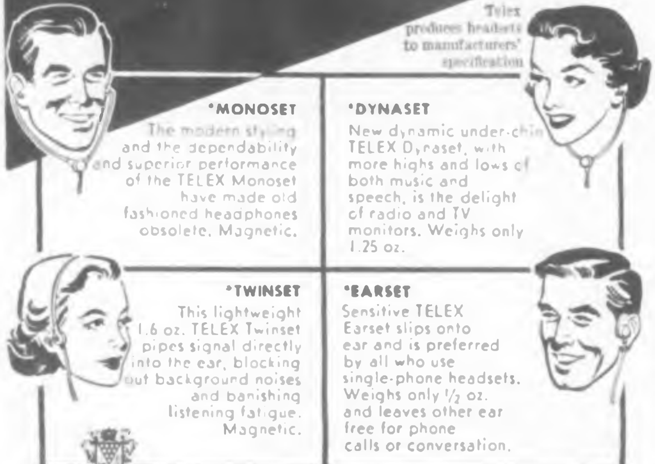

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17—Remote Pickup-Audio

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Auxiliary power supplies ....RB
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DC to AC converters ....RD
Remote mixing equipment ....RE
Transmitters ....RF

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Audio & Video Products Corp., 730 Fifth Ave., New York 3, N. Y.—RA, RB, RE
Beam Instruments Corp., 350 Fifth Ave., New York 1, N. Y.—RA
Bogen Co., D., 29 9 Ave., New York, N. Y.—RE
Bogue Railway Equipment Div., 52 Iowa Ave., Paterson 5, N. J.—RB
Budelman Radio Corp., 375 Fairfield Ave., Stamford, Conn.—RC, RF

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High (HF	3-30 MC
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Super High (SHF)	3000-30,000 MC
Extremely High (EHF)	30,000-300,000 MC

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Dittmore & Freimuth Co., 2517 E. Norwich St., Cudahy, Wisc.—RB
Electrodyne Co., 32 Oliver St., Boston, Mass.—RD
Electronic Development Laboratory, 45-07 23 Ave., Long Island City 5, N. Y.—RA, RB, RE
Equipment & Service Co., 6815 Oriole Dr., Dallas 9, Tex.—RA, RB, RE
Erwood Inc., 1770 W. Berteau Ave., Chicago 13, Ill.—RA, RB
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Northern Radio Co., 314 Bell, Seattle, Wash.—RA
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Sierra Electronic Corp., 1050 Brittan Ave., San Carlos, Calif.—RF
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Sound Laboratories, 323 E. 48 St., New York 17, N. Y.—RA
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Stephens Mfg. Corp., 8538 Warner Drive, Culver City, Calif.—RF
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Synchrotone Film Sound, Inc., 1776 Broadway, New York 19, N. Y.—RC
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American Microphone Co., 370 S. Fair Oaks Ave., Pasadena 1, Calif.—SH
Astatic Corp., 250 Harbor, Conneaut, Ohio—SH, SM
Atlantic Video Corp., 18 Clinton St., Brooklyn 2, N. Y.—SI
Audak Co., 500 Fifth Ave., New York, N. Y.—SM
Audio Industries, Michigan City, Ind.—SA
Audio-Master Corp., 341 Madison Ave., New York 17, N. Y.—SG, SI, SJ, SQ
Audio & Video Products Corp., 730 Fifth Ave., New York 3, N. Y.—SA, SB, SC, SD, SE, SF, SG, SH, SI, SJ, SK, SL, SM, SN, SO, SP, SQ, SR
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1951	$41,600,000 profit
1950	$ 9,200,000 loss
1949	$25,300,000 loss

* Income before Federal income tax

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Beam Radionics Corp., 224 N. Desplaines St., Chicago 6, Ill.—SG
Bell Sound Systems, Inc., 555 Marion Road, Columbus 7, Ohio—SA, SL
Berger Communications, 109-01 72nd Rd., Forest Hills, L. I., N. Y.—SA, SB
Bodine Electric Co., 2254 W. Ohio St., Chicago 12, Ill.—SF
Bogen Co., 663 Broadway, New York, N. Y.—SQ
Bogue Railway Equipment Div., 52 Iowa Ave., Paterson 5, N. J.—SF
Brush Development Co., The, 3405 Perkins Ave., Cleveland 14, Ohio—SH, SM
Buhl Optical Co., 1009 Beech Ave., Pittsburgh 12, Pa.—SE

Califone Corp., 1041 N. Sycamore Ave., Hollywood 38, Calif.—SI, SQ
Caltron Products Co., 1406 S. Hobart Blvd., Los Angeles 6, Calif.—SH
Camera Equipment Co., 1600 Broadway, New York 19, N. Y.—SA, SB
Camera Mart, Inc., The, 1845 Broadway, New York 23, N. Y.—SA, SB
Carron Mfg. Co., 741 W. Harrison St., Chicago 7, Ill.—SF, SM
Cinema Engineering Co., 1510 W. Verdugo Ave., Burbank, Calif.—SL
Collins Audio Products Co., P. O. Box 368, Westfield, N. J.—SQ
Collins Radio Co., 855 35 St., N. E., Cedar Rapids, Iowa—SL
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Crescent Industries, Inc., 5900 W. Touhy Ave., Chicago 31, Ill.—SJ
Crestwood Recorder Corp., 5940 N. Northwest Highway, Chicago 31, Ill.—SA
Cyclohm Motor Corp., Div. Howard Industries, Racine, Wisc.—SF
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Electric Specialty Co., 211 South St., Stamford, Conn.—SF
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Electronics Contracting Co., 122 Chambers St., New York 7, N. Y.—SA, SL
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Ferrar Radio & Television Corp., 55 W. 26 St., New York 10, N. Y.—SI
Fisher Radio Corp., 41 E. 47th St., New York 17, N. Y.—SL
Garod Radio Corp., 70 Washington St., Bklyn, N. Y.—SA
Garrard Sales Corp., 164 Duane, New York, N. Y.—SJ
Gates Radio Co., 123 Hampshire St., Quincy 1, Ill.—SC, SD, SE, SF, SG, SH, SI, SL, SM, SN, SO, SQ, SR
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General Industries Co., Elyria, Ohio—SF, SN
Globe Industries, 125 Sunrise Place, Dayton, Ohio—SF
Gray Research & Development Co., 658 Hilliard St., Manchester, Conn.—SH
Grem Engineering Co., 206 8th Ave., Brooklyn 15, N. Y.—SA, SB, SL
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Hertner Electric Co., The, 12690 Elmwood Ave., Cleveland 11, Ohio—SF
Holtzer-Cabot, 125 Amory, Boston 19, Mass.—SF
International Research Associates, A Div. of Iresco Inc., 2221 Warwick Ave., Santa Monica, Calif.—SL
Key Electronics Corp., 20 W. 22 St., New York 10, N. Y.—SI, SQ
Korb Engineering & Mfg. Co., 30 Ottawa Ave., Grandville, Mich.—SL
Lincoln Engineering Co., 5701 Natural Bridge Ave., St. Louis 20, Mo.—SJ
Lindberg Instrument Co., 1800 Harmon St., Berkeley, Calif.—SO
Lipps, Edwin A., 5485 W. Washington Blvd., Los Angeles 16, Calif.—SE, SM, SO
McIntosh Lab., 320 Water St., Binghamton, N. Y.—SL
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6T4	Triode oscillator
5768	Planar triode amplifier, frequency multiplier

Manufacturer's Laboratory, 10610 Keswick, Sun Valley, Calif.—SH
Marble Card Electric Co., Gladstone, Mich.—SF
Milwaukee Stamping Co., 800 S. 72 St., Milwaukee 14, Wisc.—SJ
MP Concert Installations, Fairfield, Conn.—SL
Newcomb Audio Products Co., 6824 Lexington Ave., Hollywood 38, Calif.—SQ
Pacific Transducer Corp., 11921 S. West Pico Blvd., Los Angeles 64, Calif.—SE, SH, SO
Pan-Electronics Co., 276 E. 150 St., New York, N. Y.—SB, SI, SL, SQ
Peirce Wire Recorder Corp., 1328 Sherman, Evanston, Ill.—SM, SO
Pfanstiehl Chemical Co., 104 Lake View Ave., Waukegan, Ill.—SH, SO
Pickering & Co., 309 Woods Ave., Oceanside, N. Y.—SH, SO
Poinsettia, Inc., 112 Cedar, Pitman, N. J.—SK
Precision Electronics Inc., 641 Milwaukee Ave., Chicago 22, Ill.—SL
Premier Electronic Labs., 382 Lafayette St., New York 3, N. Y.—SA, SL
Presto Recording Corp., Box 500, Paramus, N. J.—SB, SO, SH, SM
Proctor Soundex Corp., 133 N. 6th Ave., Mount Vernon, N. Y.—SI
QRK Electronic Products, 445 N. Circle Dr., Fresno 4, Calif.—SI, SN
Radio Corporation of America, RCA-Victor Div., Camden, N. J.—SA, SB, SC, SD, SE, SF, SG, SH, SI, SJ, SL, SM, SN, SO, SP, SQ, SR
Radio-Music Corp., 84 S. Water St., Port Chester, N. Y.—SG, SH, SN, SO, SP, SQ, SR
Recoton Corp., 147 W. 22, New York, N. Y.—SJ, SO
Redmond Co., Owosso, Mich.—SF
Rek-O-Kut Co., 38-01 Queens Blvd., Long Island City 1, N. Y.—SA, SB, SC, SD, SG, SI, SL, SM, SN, SQ, SR
Remler Co., 2101 Bryant St., San Francisco 10, Calif.—SL
Robinson Recording Labs., 35 S. 9th St., Philadelphia 7, Pa.—SB, SC, SD, SH, SQ
Rowe Industries, 1702 Wayne, Toledo, Ohio—SL
Scott, Inc., Herman Hosmer, 385 Putnam Ave., Cambridge 39, Mass.—SL
Shura-Tone Products, Inc., 440 Adelphi St., Brooklyn 17, N. Y.—SL, SR
Simpson Mfg. Co., Mark, 32-28 49 St., Long Island City 3, N. Y.—SA
Sonotone Corp., Elmsford, N. Y.—SO
Sound Laboratories, 323 E. 48th St., New York 17, N. Y.—SI, SL
Sound Projects Co., 2810 W. Harrison St., Chicago 12, Ill.—SO
Sound Sales & Engineering Co., 2005 La Branch, Houston 3, Tex.—SA, SB, SH, SI, SJ, SL, SN, SO, SQ, SR
SoundScriber Corp., The, 146 Munson St., New Haven 4, Conn.—SA, SB
Speak-O-Phone Recording & Equipment Co., 23 W. 60 St., New York 23, N. Y.—SA
Stancil-Hoffman Corp., The, 1016 N. Highland Ave., Hollywood 38, Calif.—SA, SB, SP
Steelman Phonograph & Radio Co., 12-30 Anderson Ave., Mt. Vernon, N. Y.—SJ, SQ
Stelma, Inc., 389 Ludlow St., Stamford, Conn.—SL
Stromberg-Carlson Co., 1225 Clifford Ave., Rochester, N. Y.—SJ, SL, SQ
Tape Recording Industries, 3335 E. Michigan Ave., Lansing, Mich.—SA, SG, SH, SI, SJ, SM, SN, SQ, SR
Telectro Industries Corp., 35-16 37 St., Long Island City 1, N. Y.—SL
Televex, 474 W. 238 St., New York 63, N. Y.—SE
Tetrad Corp., 62 St. Mary St., Yonkers, N. Y.—SH
U. S. Motor Co., 200 E. Slauson Ave., Los Angeles 11, Calif.—SF
U. S. Recording Co., 1121 Vermont Ave., N. W., Washington 5, D. C.—SA, SB, SC, SD, SE, SF, SG, SH, SI, SJ, SK, SL, SM, SN, SO, SQ, SR
Universal Broadcast Equipment Co., 6035 Northwest Highway, Chicago 31, Ill.—SO
Valentino, Inc., Thomas J., 150 W. 46 St., New York 36, N. Y.—SA, SB, SK
Van Eps Lab., R. D. 2, Plainfield, N. J.—SB, SD, SE, SM
V-M Corp., 280 Park, Benton Harbor, Mich.—SG, SI
Weathers Industries, 66 E. Gloucester Pike, Barrington, N. J.—SH, SO
Webster-Chicago Corp., 5610 W. Bloomingdale Ave., Chicago 34, Ill.—SA, SI, SJ
Wenzel Projector Co., 2511 S. State St., Chicago 16, Ill.—SP
Western Sound & Electric Labs., 805 S. 5th St., Milwaukee, Wisc.—SA
White Rock Mfg. Corp., White Rock, S. C.—SA
Wilcox Gay Corp., Charlotte, Mich.—SA
Williams, Brown & Earle, Inc., 918 Chestnut St., Philadelphia 7, Pa., SE, SJ

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Custom Imperial 400

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World's finest extended range speaker
Silver gray player base with chrome pickup, turntable and trim

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- 16 mm portable ....TC
- 16 mm studio ....TD
- 35 mm portable ....TE
- 35 mm studio ....TF
- 17.5 mm portable ....TG
- 17.5 mm studio ....TH

Recorders, photographic
- 8 mm portable ....TI
- 8 mm studio ....TJ
- 16 mm portable ....TK
- 16 mm studio ....TL
- 35 mm portable ....TM
- 35 mm studio ....TN

Synchronized tape equipment ....TO

Ampex Electric Corp., 934 Charter St., Redwood City, Calif.—TO
Audio & Video Products Corp., 730 Fifth Ave., New York 3, N. Y.—TO
Bell & Howell Co., 7100 McCormick Road, Chicago 45, Ill.—TC
Berndt-Bach, Inc., Auricon Div., 7325 Beverly Blvd., Los Angeles 36, Calif.—TK, TL
Camera Equipment Co., 1600 Broadway, New York 19, N. Y.—TC, TD, TE, TF, TG, TH, TK, TL, TM, TN, TO
Camera Mart, Inc., The, 1845 Broadway, New York 23, N. Y.—TC, TD, TE, TF, TG, TH, TK, TL, TM, TN, TO
Cinematic Devel. & Cine. Lab., 2125 32nd Ave., San Francisco, Calif.—TD, TK, TL, TM, TN, TO
Cinetech Co., 106 West End Ave., New York 23, N. Y., TK, TL, TM, TN
Collins Audio Products Co., Box 368, Westfield, N. J.—JE
Daystrom Electric Corp., 837 Main St., Poughkeepsie, N. Y.—TE, TF
Electro Vision Laboratory, 30-06 Crescent St., Long Island City 2, N. Y.—TO
Fairchild Recording Equipment Corp., 154th St. & 7th Ave., Whitestone 57, N. Y.—TO
Feiler Engineering Co., 8026 Monticello Ave., Skokie, Ill.—TK
Hallen Corp., 3503 W. Olive Ave., Burbank, Calif.—TC, TD, TE, TF, TG, TH
Hart, Artnur H., 2125 32 Ave., San Francisco 16, Calif.—TC, TG, TL
Heller & Associates, Herman S., 8414 W. 3 St., Los Angeles 48, Calif.—TA, TB, TC, TD, TE, TF, TG, TH
Korb Engineering & Mfg. Co., 30 Ottawa Ave., Grandville, Mich.—TO
Libra Film & Equipment, 6525 Sunset Blvd., Hollywood 28, Calif.—TK, TL
Mannon Sound Stages, Inc., 112 W. 89th St., New York 24, N. Y.—TK, TL
Maurer, Inc., J. A., 37-01 31 St., Long Island City 1, N. Y.—TK, TL
Micro Eng'g Corp., 6233 Hollywood Blvd., Hollywood 28, Calif.—TA, TB, TC, TD, TE, TF, TG, TH, TI, TJ, TK, TL, TM, TN, TO
Miles Reproducer Co., 812 Broadway, New York 3, N. Y.—TA, TC, TI, TJ, TK, TO
Motiograph Inc., 4431 W. Lake, Chicago, Ill.—TC
Movie-Mite Corp., 1105 Truman Rd., Kansas City 6, Mo.—TC, TO
Radio Corporation of America, RCA-Victor Div., Camden, N. J.—TA, TB, TC, TD, TE, TF, TG, TH, TI, TJ, TK, TL, TM, TN
S. O. S. Cinema Supply Corp., 602 W. 52 St., New York 19, N. Y.—TC, TD, TG, TH, TK, TL, TM, TN, TO
Stancil-Hoffman Corp., The, 1016 N. Highland Ave., Hollywood 38, Calif.—TC, TD, TE, TF, TG, TH
Synchrotone Film Sound, Inc., 1776 Broadway, New York 19, N. Y.—TE, TF, TG, TH
Tape Recording Industries, 3335 E. Michigan Ave., Lansing, Mich.—TO
Victor Animatograph Corp., Davenport Bank Bldg., Davenport, Iowa—TC
Walkirt Co., The, 145 W. Hazel St., Inglewood 3, Calif.—TE, TF

20—Tape

- Mechanisms ....UA
- Power supplies ....UB
- Recorders, miniature portable ....UC
- Recorders, portable ....UD
- Recorders, studio ....UE
- Recording amplifiers ....UF
- Recording heads ....UG
- Special equipment ....UH
- Synchronized equipment ....UI
- Tape indexer ....UJ

Accurate Engineering Co., 2005 Blue Island Ave., Chicago 8, Ill.—UB
Acorn Electronics Corp., Box 348, Gibson City, Ill.—UB
Alfax Paper & Engineering Co., Box 125, Westboro, Mass.—UC, UD
American Hydromath Corp., 145 57th St., New York 19, N. Y.—UH
American Television & Radio Co., 300 E. 4th St., St. Paul 1, Minn.—UB
Ampex Electric Corp., 934 Charter St., Redwood City, Calif.—UA, UB, UC, UD, UE, UF, UG, UH, UI
Amplifier Corp. of America, 398 Broadway, New York 13, N. Y.—UA, UC, UD, UE, UF, UG, UH, UJ
Ampro Corp., 2835 N. Western Ave., Chicago 18, Ill.—UD, UF

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Aurex Corp., 1117 N. Franklin St., Chicago 10, Ill.—UA, UC
Beam Instruments Corp., 350 Fifth Ave., New York 1, N. Y.—UC
Bell Sound Systems, Inc., 555 Marion Road, Columbus 7, Ohio—UD, UF
Berlant Associates, 4917 W. Jefferson Blvd., Los Angeles 16, Calif.—UA, UD, UE, UF, UG, UH
Bogue Railway Equipment Div., 52 Iowa Ave., Paterson 5, N. J.—UD
Bone Engineering Corp., 701 W. Broadway, Glendale 4, Calif.—UB, UF
Broadcast Equipment Specialties Corp., 135-01 Liberty Ave., Richmond Hill 19, N. Y.—UC, UD
Brush Development Co., The, 3405 Perkins Ave., Cleveland 14, Ohio—UA, UB, UD, UF, UG
Burgess Battery Co., Freeport, Ill.—UB
Califone Corp., 1041 N. Sycamore Ave., Hollywood 38, Calif.—UD, UE
Camera Equipment Co., 1600 Broadway, New York 19, N. Y.—UC, UD, UE
Carron Mfg. Co., 741 W. Harrison St., Chicago 7, Ill.—UA, UC, UD, UG
Carter Motor Co., 2654 N. Maplewood Ave., Chicago 47, Ill.—UB
Cinema Engineering Co., 1510 W. Verdugo Ave., Burbank, Calif.—UE, UF, UG
Cinetech Co., 106 West End Ave., New York 23, N. Y.—UB, UD, UE, UF
Conn. Telephone & Electric Corp., 70 Britannia St., Meriden, Conn.—UA, UB, UC, UD, UF, UH
Cook Electric Co., 2700 N. Southport Ave., Chicago 14, Ill.—UD, UE
Daco Machine & Tool, 202 Tillary St., Brooklyn 1, N. Y.—UA
Dittmore & Freimuth Co., 2517 E. Norwich St., Cudahy, Wisc.—UB
Dukane Corp., 110 N. 11, St. Charles, Ill.—UD
Ectro Inc., Delaware, Ohio—UD
Edix Eng'g Co., 10495 Scenario Lane, Los Angeles 24, Calif.—UH
EDL Co., 5929 East Dunes Hiway, Miller Station, Gary, Ind.—UH
Elcor, Inc., 1501 W. Congress St., Chicago 7, Ill.—UD, UG
Electronic Creations Co., 376 Greenwich St., New York, N. Y.—UC
Electronic Development Laboratory, 43-07 23 Ave., Long Island City 5, N. Y.—UB, UF
Electro Vision Laboratory, 30-06 Crescent St., Long Island City 2, N. Y.—UA, UH, UI
Fairchild Recording Equipment Corp., 154th St. & 7th Ave., Whitestone 57, N. Y.—UB, UD, UE, UF, UH, UI
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Ferranti Electric, Inc., 30 Rockefeller Plaza, New York 20, N. Y.—UB
General Industries Co., Olive & Taylor St., Elyria, Ohio—UA, UD, UH
Grem Engineering Co., 206 8th Ave., Brooklyn 15, N. Y.—UD, UE
Heller & Associates, Herman S., 8414 W. 3 St., Los Angeles 48, Calif.—UC, UD, UE, UG, UH, UI
Indiana Steel Products, Valparaiso, Ind.—UG
INET, Inc., 8655 S. Main, Los Angeles, Calif.—UB
Int'l Movie Producers' Service, 515 Madison Ave., New York 22, N. Y.—UD
Kepco Laboratories, Inc., 131-38 Sanford Ave., Flushing 55, N. Y.—UB
Kinevox Inc., 116 S. Hollywood Way, Burbank, Calif.—UB, UD, UE, UG, UI
Korb Engineering & Mfg. Co., 30 Ottawa Ave., Grandville, Mich.—UF, UH, UI
Lekas Mfg. Co., 111 S. 4th Ave., Ann Arbor, Mich.—UD, UE
Lipps, Edwin A., 5485 W. Washington Blvd., Los Angeles 16, Calif.—UG
McIntosh Lab., Inc., 320 Water St., Binghamton, N. Y.—UF
Magnecord, Inc., 225 W. Ohio St., Chicago 10, Ill.—UA, UD, UE, UF, UG, UH
Magnetic Recorders Co., 7124 Melrose Ave., Los Angeles 46, Calif.—UD
Magnetic Recording Industries, 30 Broad St., New York 4, N. Y.—UB, UD, UF, UH
Mannon Sound Stages, Inc., 112 W. 89th St., New York 24, N. Y.—UE
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Melpar, Inc., 452 Swann Ave., Alexandria, Va.—UG, UH
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Pedersen Electronics, Box 572, Lafayette, Calif.—UB
Pentron Corp., The, 221 E. Cullerton Ave., Chicago 16, Ill.—UA, UD, UG
Permoflux Corp., 4900 W. Grand Ave., Chicago 39, Ill.—UD, UH
Premier Electronic Labs., 382 Lafayette St., New York 3, N. Y.—UD, UF
Presto Recording, P. O. Box 500, Paramus, N. J.—UE
Product Associates, Inc., 318 W. Olympic Blvd., Los Angeles 15, Calif.—UD
Radio Corporation of America, RCA-Victor Div., Camden, N. J.—UA, UE, UF, UG, UH, UI, UJ
Radio Laboratories, Inc., 1846 Westlake North, Seattle 9, Wash.—UF
Rangertone, 73 Winthrop St., Newark, N. J.—UE
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294 International Resistance Co.
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295 International Telephone and Telegraph Corp.
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296 J F D Mfg. Co.
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297 Johnson Co., E. F.
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337 Radio Materials Corp.
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340 Raytheon Mfg. Co.
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344 Sarkes Tarzian, Inc.
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348 Sprague Electric Co.
Dry electrolytic capacitors

349 Stainless, Inc.
Tubular stainless steel towers

350 Standard Electronics Corp.
Transmitters

351 Standard Piezo Co.
Crystals

352 Standard Transformer Co.
Sealed transformers for oscillators

353 Steward Mfg. Co., D. M.
High permeability ferrite components

354 Superior Tube Co.
Metal tubing, reprint on cathode alloys

355 Supreme, Inc.
Panel meters with high torque movement

356 Sylvania Electric Products Inc.
Terminal strips, sockets, tubes, plugs

357 Sylvania Electric Products Inc.
Subminiature long-life vacuum tubes

358 Sylvania Electric Products Inc.
Stamped and dip-soldered circuits

359 Synthane Corp.
Laminated plastics

360 Tektronix, Inc.
Oscilloscope for TV transmitters, studio

361 Telecomputing Corp.
Automatic data plotters

362 Television Utilities Corp.
Television monitors

363 Telex, Inc.
Lightweight headsets and earsets

364 Tel-Rad Mfg. Co., Inc.
Deflection yokes, components

365 Terminal Radio Corp.
Radio and electronic equipment

366 Trimm, Inc.
Headsets, phone plugs, cords, jacks

367 Tru-Ohm Prods. Div. Model Eng. & Mfg. Inc.
Resistors, power rheostats

368 Truscon Steel Co.
Self-supporting steel towers

369 U. S. Engineering Co.
Electronic hardware, lugs, bushings

370 U. S. Wire & Cable
Transmission wire

371 University Loudspeakers
Loudspeakers

372 Vesto Co., Inc.
Self supporting steel towers

373 Ward Products Corp.
Mobile communication antennas, accessories

374 Weckesser Co.
Nylon cable clips

375 Wells Sales, Inc.
Electronic components, motors, antennas

376 Westinghouse Electric Corp.
Power, receiving and picture tubes

377 Westinghouse Electric Corp.
Magnetic cores

378 White Dental Mfg., S. S.
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379 Wiley & Sons Inc., John
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Export Dept.: 13 East 40th St., New York 16, N. Y., Cables "ARLAB"

Sealtron Co., The, 9701 Reading Road, Cincinnati 15, Ohio—UB
Shoup Engineering Co., 221 E. Cullerton, Chicago 16, Ill.—UD, UE, UF, UG, UH
Shure Brothers, Inc., 225 W. Huron St., Chicago 10, Ill.—UG
Simpson Mfg. Co., 32-28 49 St., Long Island City 3, N. Y.—UD
Skiatron Electronics & TV, 30 E. 10th St., New York 3, N. Y.—UH
Smith Assoc., Rawdon, 2217 M St., N. W., Washington 7, D. C.—UE, UF
Sonar Radio Corp., 59 Myrtle Ave., Bklyn 1, N. Y.—UA, UD, UF
S. O. S. Cinema Supply Corp., 602 W. 52 St., New York 19, N. Y.—UD, UE, UF, UI
Sound Devices, Inc., 129 E. 124, New York, N. Y.—UG
Sound, Inc., 221 E. Cullerton, Chicago, Ill.—UD, UF
Sound Laboratories, 323 E. 48th St., New York 17, N. Y.—UF
Sound Sales & Engineering Co., 2005 La Branch, Houston 3, Tex.—UA, UC, UD, UF
SoundScriber Corp., The, 146 Munson St., New Haven 4, Conn.—UD, UE
Speak-O-Phone Recording & Equipment Co., 23 W. 60 St., New York 23, N. Y.—UH
Stancil-Hoffman Corp., The, 1016 N. Highland Ave., Hollywood 38, Calif.—UA, UC, UD, UE, UF, UG, UH
Synchromatic Prods., 766 Broadway, Bayonne, N. J.—UE
Synchrotone Film Sound, Inc., 1776 Broadway, New York 19, N. Y.—UD
Tape Recording Industries, 3335 E. Michigan Ave., Lansing, Mich.—UA, UD, UE, UG
Tapetone Mfg. Corp., 202 Tillary St., Brooklyn, N. Y.—UD
Tech Labs, Inc., Bergen & Edsall Blvd., Palisades Park, N. J.—UH
TelAutograph Corp., 16 W. 61 St., New York 23, N. Y.—UB, UF
Telectro Industries Corp., 35-16 37 St., Long Island City 1, N. Y.—UA, UB, UC, UD, UF, UH, UJ
U. S. Recording Co., 1121 Vermont Ave., N. W., Washington 5, D. C.—UA, UB, UC, UD, UE, UF, UG, UH
Universal Electronics Co., 2012 S. Sepulveda Blvd., Los Angeles 25, Calif.—UB
Universal Molded Products Corp., Bristol, Va.—UD
Varo Mfg. Co., 1801 Walnut, Garland, Tex.—UB
Walkrit Co., The, 115 W. Hazel St., Inglewood 3, Calif.—UA
Webster-Chicago Corp., 5610 W. Bloomingdale Ave., Chicago 34, Ill.—UD
Webster Electric Co., 1900 Clark, Racine, Wis.—UD
Wenzel Projector Co., 2511 S. State St., Chicago 16, Ill.—UH
Williams, Brown & Earle, Inc., 918 Chestnut St., Philadelphia 7, Pa.—UD
Wilcox-Gay Corp., Charlotte, Mich.—UD

21—Wire

Recorders, miniature portable .... VA
Recorders, portable .... VB
Recorders, studio VC
Recording heads .... VD
Synchronized equipment .... VE

Aurex Corp., 1117 N. Franklin, Chicago, Ill.—VA
Brush Development Co., The, 3405 Perkins Ave., Cleveland 14, Ohio—VB, VD
Crescent Industries, Inc., 5900 W. Touhy Ave., Chicago 31, Ill.—VB, VD
Electron Enterprises, 6917 W. Stanley Ave., Berwyn, Ill.—VB
Geratron Products, 2115 N. Charles St., Baltimore 18, Md.—VB
Korb Engineering & Mfg. Co., 30 Ottawa Ave., Grandville, Mich.—VB
Lear, Inc., 110 Ionia Ave., N. W., Grand Rapids 2, Mich.—VB, VC
Mannon Sound Stages, Inc., 112 W. 89th St., New York 24, N. Y.—VC
Marconi's Wireless Telegraph, 23 Beaver St., New York 4, N. Y.—VB
Miles Reproducer Co., 812 B'way, New York, N. Y.—VA
Molded Insulation Co., 335 E. Price St., Philadelphia, Pa.—VC
Peirce Wire Recorder Corp., 1328 Sherman, Evanston, Ill.—VA, VB
Rowe Industries, 1702 Wayne, Toledo, Ohio—VC
Sound Sales & Engineering Co., 2005 La Branch, Houston 3, Tex.—VB
Synchromatic Prods., 766 Broadway, Bayonne, N. J.—VE
Telectro Industries Corp., 35-16 37 St., Long Island City 1, N. Y.—VA, VB
Tensolite Insulated Wire Co., Tarrytown, N. Y.—VA, VB, VC, VD
Webster-Chicago Corp., 5610 W. Bloomingdale Ave., Chicago 34, Ill.—VB

22—Graphic

Drives, electric .... WA
Drives, flexible auto .... WB
Drives, spring .... WC
Facsimile equipment .... WD
Recorders, fixed .... WE
Recorders, portable .... WF
Teletype equipment .... WG

Alfax Paper & Engineering Co., Box 125, Westboro, Mass.—WD
Audak Co., 500 5th Ave., New York 18, N. Y.—WE
Audio-Tone Oscillator Co., 237 John St., Bridgeport 3, Conn.—WE, WF
Boehme Inc., H. O., 915 Broadway, New York, N. Y.—WA, WB, WE, WF
Clarke Instruments, 919 Jesup Blair Drive, Silver Spring, Md.—WB
Collins Radio Co., 855 35 St., N. E., Cedar Rapids, Iowa—WG
Douglas Aircraft Co., Santa Monica, Calif.—WE
Edin Co., 207 Main St., Worcester 8, Mass.—WA, WE, WF
Electric Tachometer Corp., 2218 Vine St., Philadelphia 3, Pa.—WE
Electro-Tech Equipment Co., 308 Canal St., New York 13, N. Y.—WE, WF
Esterline-Angus Co., Box 596, Indianapolis 6, Ind.—WA, WC, WE, WF
Fairchild Recording Equipment Corp., 154th St. & 7th Ave., Whitestone 57, N. Y.—WD
Fielden Instrument Corp., 2920 N. Fourth St., Philadelphia 33, Pa.—WE
Gorrell & Gorrell, 336 Old Hook Rd., Westwood, N. J.—WA
Hathaway Instrument Co., 1315 Clarkson St., Denver, Colo.—WE, WF
Haydon Mfg. Co., 245 E. Elm St., Torrington, Conn.—WA
Heiland Research Corp., 130 E. 5th Ave., Denver 9, Colo.—WE, WF
Heller & Associates, Herman S., 8414 W. 3 St., Los Angeles 48, Calif.—WE, WF
Las-Lab, 316 W. Saratoga St., Baltimore 1, Md.—WE, WF
Leupold & Stevens Instruments, 4445 N. E. Gilsam St., Portland 13, Ore.—WE
North American Philips Co., 100 E. 42nd St., New York 17, N. Y.—WE
Photron Instrument Co., 6516 Detroit Ave., Cleveland 2, Ohio—WE
Remler Co., 2101 Bryant St., San Francisco 10, Calif.—WG
Servo-Tek Products Co., 1 Godwin Ave., Paterson 1, N. J.—WA
Sound Apparatus Co., Stirling, N. J.—WE, WF
Stewart Mfg. Corp., F. W., 4311-13 Ravenswood Ave., Chicago 13, Ill.—WB
Techno Instrument Co., 6666 Lexington Ave., Los Angeles 38, Calif.—WE
TelAutograph Corp., 16 W. 61 St., New York 23, N. Y.—WD
Telechron Dept., General Electric Co., Ashland, Mass.—WA
Telecomputing Corp., Burbank, Calif.—WE
Times Facsimile Corp., 540 W. 58 St., New York 19, N. Y.—WD
U. S. Gauge Div., American Machine & Metals Inc., Sellersville, Pa.—WE, WF
Zernickow Co., 15 Park Row, New York, N. Y.—WF

23—Supplies

Anti-static devices .... XA
Cutting needles .... XB
Discs XC
Film .... XD
Film, magnetic stripe .... XE
Miscellaneous .... XF
Motion picture film reels & cans .... XG
Paper rolls .... XH
Playback needles XI
Reproducing needles .... XJ
Tape .... XK
Tape erasers XL
Tape reels and flanges .... XM
Tape splicers .... XN
Wire .... XO

Ace Electric Mfg. Co., 1458 Shakespeare Ave., Bronx 52, N. Y.—XN
Acton Co., H. W., Nashua, N. H.—XB, XJ
Advance Recording Products Co., 36-12 34 St., Long Island City 1, N. Y.—XC
Aeronautical Radio Mfg. Co., 155 First St., Mineola, N. Y.—XA, XO
Allied Recording Products Co., 21-09 43rd Ave., Long Island City 1, N. Y.—XC
American Laubscher Corp., 333 W. 52nd St., New York 19, N. Y.—XB, XI
Ampex Electric Corp., 934 Charter St., Redwood City, Calif.—XK, XM
Amplifier Corp. of America, 398 Broadway, New York 13, N. Y.—XK, XL, XN
Ansco Div., General Aniline & Film Corp., Binghamton, N. Y.—XD
Audio Devices, Inc., 444 Madison Ave., New York 22, N. Y.—XB, XC, XD, XE, XI, XJ, XK
Audio-Master Corp., 341 Madison Ave., New York 17, N. Y.—XK
Audio & Video Products Corp., 730 Fifth Ave., New York 3, N. Y.—XB, XC, XF, XI, XJ, XK, XL, XM, XN
Avery Adhesive Label Corp., 1616 S. Calif. Ave., Monrovia, Calif.—XF
Bell & Howell Co., 7100 McCormick Rd., Chicago 45, Ill.—XE
Berndt-Bach, Inc., Auricon Div., 7325 Beverly Blvd., Los Angeles 36, Calif.—XD
Brush Development Co., The, 3405 Perkins Ave., Cleveland 14, Ohio—XK, XO
Camera Equipment Co., 1600 Broadway, New York 19, N. Y.—XK, XL, XM, XN
Camera Mart, Inc., The, 1845 Broadway, New York 23, N. Y.—XD, XE, XG, XK, XL, XM, XN
Chase Brass & Copper Co., 236 Grand St., Waterbury 20, Conn.—XO
Chester Cable Corp., Chester, N. Y.—XO
Cinema Engineering Co., 1510 W. Verdugo Ave., Burbank, Calif.—XL
Cinematic Devel. & Cine. Lab., 2125 32nd Ave., San Francisco 16, Calif.—XD, XG
Colonial Films, 2118 Mass. Ave., N. W., Washington 8, D. C.—XD
Compco Corp., 2251 W. St. Paul Ave., Chicago 47, Ill.—XG, XM
Cornish Wire Co., 50 Church, New York, N. Y.—XO
Cummins Business Machines Corp., 4740 Ravenswood Ave., Chicago 40, Ill.—XF

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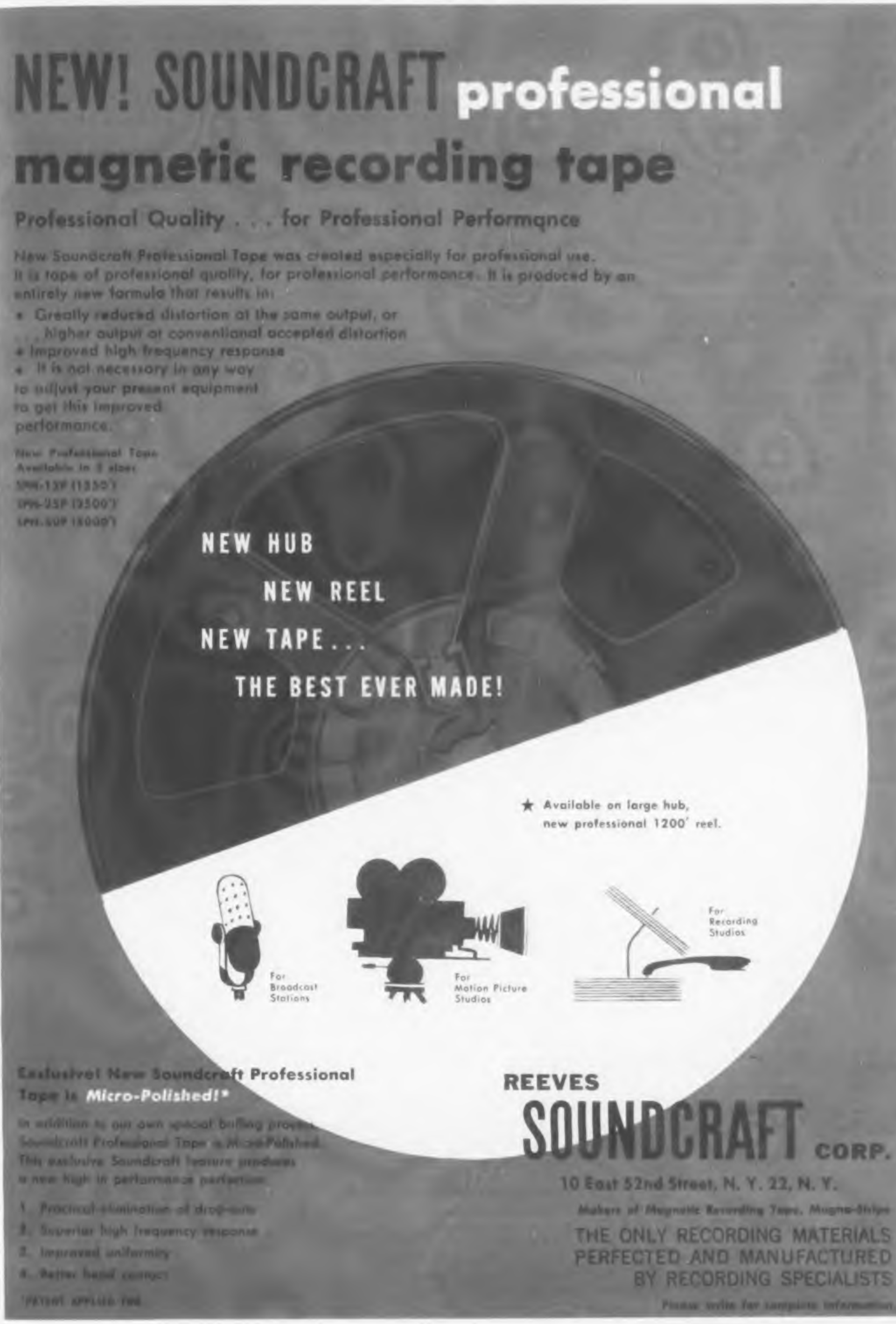
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Diamond Wire & Cable Co., 380 Harvester St., Syracuse, Ill.—XO
Driver-Harris Co., 201 Middlesex St., Harrison, N. J.—XO
DuPont de Nemours & Co., E. I., 10th & Market Sts., Wilmington 98, Del.—XD
Duotone Co., Locust St., Keyport, N. J.—XB, XC, XI, XJ, XK, XM
Eastman Kodak, 343 State, Rochester 4, N. Y.—XD
Edin Co., 207 Main St., Worcester 8, Mass.—XH
Electronic Development Lab., 43-07 23 Ave., Long Island City 5, N. Y.—XB, XC, XK, XL, XM
Electrovox Co., 60 Franklin St., E. Orange, N. J.—XA, XB, XJ
Essex Wire, 1601 Wall St., Ft. Wayne, Ind.—XO
Federal Sapphire Products Co., P. O. Box 245, Fairlawn, N. J.—XB, XI, XJ
Fidelitone, Inc., 1616 Devon Ave., Chicago 26, Ill.—XK, XO
Film Research Associates, 150 E. 52nd St., New York 22, N. Y.—XG
Gatti, Inc., Aurele M., 524 E. Washington St., Trenton 9, N. J.—XJ
General Cement Mfg. Co., 919 Taylor Ave., Rockford, Ill.—XK, XM, XO
General Insulated Wire Works, Inc., 69 Gordon Ave., Providence 5, R. I.—XO
Hart, Arthur H., 2125 32 Ave., San Francisco 16, Calif.—XD, XG
Heller & Associates, Herman S., 8414 W. 3 St., Los Angeles 48, Calif.—XE, XI, XJ, XK, XL, XN
Holub Industries, Inc., 413 DeKalb Ave., Sycamore, Ill.—XP
Imperial Radar & Wire Corp., 4342 Bronx Blvd., Bronx 66, N. Y.—XO
Industrial Cinema Service, 4119 W. North Ave., Chicago 39, Ill.—XC, XK, XO
Ind. Steel Products Co., Valparaiso, Ind.—XK
Int'l. Movie Producers', 515 Madison Ave., New York 22, N. Y.—XD, XK
Jensen Industries, Inc., 329 S. Wood St., Chicago 12, Ill.—XB, XI, XJ, XK, XM, XN
Kinevox Inc., 116 S. Hollywood Way, Burbank, Calif.—XI, XN
Kin-O-Lux, 105 W. 40th, New York 18, N. Y.—XD
Knickerbocker Annunciator Co., 75 Murray St., New York 7, N. Y.—XO
Korb Engineering & Mfg. Co., 30 Ottawa Ave., Grandville, Mich.—XO
Lenz Electric Mfg. Co., 1751 Western Ave., Chicago 47, Ill.—XO
Libra Film & Equipment, 6525 Sunset Blvd., Hollywood 28, Calif.—XD, XG
Lipps, Edwin A., 5485 W. Washington Blvd., Los Angeles 16, Calif.—XB, XI, XJ
Magnasync Mfg., 5717 Cartwright Ave., N. Hollywood, Calif.—XN
Magnecessories, Box 6960, Washington, D. C.—XN
Mallory & Co., P. R., 3029 E. Washington St., Indianapolis 6, Ind.—XA
Merix Chemical Co., 1021 E. 55th St., Chicago 15, Ill.—XA
Micro Circuits Co., New Buffalo, Mich.—XA
Miller Mfg. Co., M. A., 1169 E. 43 St., Chicago 15, Ill.—XB, XI, XJ
Minn. Electronics Corp., 47 W. Water St., St. Paul, Minn.—XL
Minn. Mining & Mfg. Co., 900 Fauquier Ave., St. Paul 6, Minn.—XD, XK, XM
Modern Wire Co., 39-30 Review Ave., Long Island City 32, N. Y.—XO
Mystik Adhesive Products, 2635 N. Kildare Ave., Chicago 39, Ill.—XF
National Electric Products Corp., Chamber of Commerce Bldg., Pittsburgh, Pa.—XO
Neumade Products Corp., 330 W. 42nd St., New York 36, N. Y.—XG
North American Philips Co., 100 E. 42nd St., New York 17, N. Y.—XB, XK
ORRadio Industries, Inc., T-120 Marvyn Rd., Opelika, Ala.—XC, XK, XN
Pacific Transducer Corp., 11921 S. West Pico Blvd., Los Angeles 64, Calif.—XI, XJ
Peerless Film Processing, 165 W. 46 St., New York 36, N. Y.—XG
Permo, Inc., 6415 Ravenswood Ave., Chicago 26, Ill.—XA, XB, XI, XJ, XK, XM, XO
Permoflux Corp., 4900 W. Grand Ave., Chicago 39, Ill.—XK
Pfanstiehl Chemical Co., 104 Lake View Ave., Waukegan, Ill.—XI, XJ
Phalo Plastics Corp., 25 Foster St., Worcester 4, Mass.—XO
Phonograph Needle Mfg. Co., 42 Dudley St., Providence 5, R. I.—XJ
Plastoid Corp., Hamburg, N. J.—XO
Presto Recording Corp., Box 500, Paramus, N. J.—XB, XC, XJ
Prestoseal Mfg. Corp., 3801 Queens Blvd., Long Island City 1, N. Y.—XN
Radio-Music Corp., 84 S. Water St., Port Chester, N. Y.—XJ
Rainbo Record Mfg. Corp., 4335 W. 147 St., Lawndale, Calif.—XC
RecorDisc Corp., 395 Broadway, New York 13, N. Y.—XB, XC, XJ, XK, XO
Recoton Corp., 147 W. 22 St., New York 11, N. Y.—XB, XC, XI, XJ, XK
Reeves Soundcraft Corp., 10 E. 52 St., New York 22, N. Y.—XB, XC, XE, XI, XJ, XK, XM, XN
Rex Corp., 51 Lansdowne St., Cambridge, Mass.—XO
Sequoia Process Corp., 894 Douglas Ave., Redwood City, Calif.—XO
Shura-tone Products, Inc., 440 Adelphi St., Brooklyn 17, N. Y.—XI, XJ
Sonic Recording Products, Inc., 58 Mill Rd., Freeport, L. I., N. Y.—XC
S.O.S. Cinema Supply, 602 W. 52 St., New York 19, N. Y.—XG, XK, XL, XM, XN
Sound Devices, Inc., 120 E. 124 St., New York 35, N. Y.—XC, XK
Sound Sales & Engineering Co., 2005 La Branch, Houston 3, Tex.—XF, XO
SoundScriber Corp., The, 146 Munson St., New Haven 4, Conn.—XC, XK, XL
Sprague Electric Co., 233 Marshall St., North Adams, Mass.—XO
Srepco Inc., 135 E. 2nd St., Dayton 2, Ohio—XF
Strandberg Recording Co., 705 Woodland Dr., Greensboro, N. Car.—XF
Taffet Radio & TV Co., 2530 Belmont Ave., New York 58, N. Y.—XA
Tape Recording Apparatus Co., Box 221, Caldwell, N. J.—XJ
Tape Recording Industries, 3335 E. Michigan Ave., Lansing, Mich.—XK, XM, XN
Tayloreel Corp., 2 Commercial St., Rochester 14, N. Y.—XG
Tensolite Insulated Wire, Tarrytown, N. Y.—XO
Tetrad Corp., The, 62 St. Mary St., Yonkers 2, N. Y.—XI, XJ
Thor Ceramics, Inc., 225 Belleville Ave., Bloomfield, N. J.—XF
U. S. Recording Co., 1121 Vermont Ave., N. W., Washington 5, D. C.—XB, XC, XI, XJ, XK, XM, XN
U. S. Rubber Co., 1230 Ave. of the Americas, New York, N. Y.—XO
Universal Reels, 9 16 37th Ave., Long Island City, N. Y.—XG
Vallorbs Jewel Co., Box 958, Lancaster, Pa.—XJ
Webster-Chicago Corp., 5610 W. Bloomingdale Ave., Chicago 39, Ill.—XK, XO
Wenzel Projector Co., 2511 S. State St., Chicago 16, Ill.—XC, XF, XG
Western Insulated Wire Co., 2425 E. 30th St., Los Angeles 35, Calif.—XO
Westline Products, 600 E. 2nd St., Los Angeles 54, Calif.—XK
Wildberg Bros., 724 Market St., San Francisco 2, Calif.—XC, XO
Williams, Brown & Earle, Inc., 918 Chestnut St., Philadelphia 7, Pa.—XD, XE, XG, XK, XM, XN
Zephyr Products Co., 129 E. 124 St., New York 35, N. Y.—XC, XI, XJ, XK

24—Servo & Telemetering

Servo devices ....YA
Telemetering equipment ....YB

Aero Electronics Co., 1542 N. Wells St., Chicago 10, Ill.—YA, YB
Airplane & Marine Instruments, Clearfield, Pa.—YA
Akeley Camera & Instrument Corp., 175 Varick St., New York 14, N. Y.—YA, XB
American Machine & Foundry Co., 625 Eighth Ave., New York 18, N. Y.—YA, YB
Ampex Electric Corp., 934 Charter St., Redwood City, Calif.—YB
Ansley Electronics, Inc., 85 Tremont St., Meriden, Conn.—YA, YB
Antenna Research Laboratory, Inc., 797 Thomas Lane, Columbus 14, Ohio—YB
Applied Science Corp. of Princeton, Box 44, Princeton, N. J.—YB
Atlantic Electronics Corp., 4 Manhasset Ave., Port Washington, N. Y.—YA
Audio Instrument Co., 133 W. 14 St., New York 11, N. Y.—YA, YB
Audio Products Corp., 2265 Westwood Blvd., Los Angeles 64, Calif.—YB
Audio-Tone Oscillator Co., 237 John St., Bridgeport 3, Conn.—YA, YB
Audio & Video Products Corp., 730 Fifth Ave., New York 3, N. Y.—YB
Automatic Temperature Control Co., Inc., 5212 Pulaski Ave., Philadelphia 44, Pa.—YA, YB
Bardwell & McAlister, 2950 N. Ontario St., Burbank, Calif.—YA, YB
Beckman Instruments, Inc., 820 Mission St., S. Pasadena, Calif.—YA
Bendix Aviation Corp., Pac. Div., 11600 Sherman Way, N. Hollywood, Calif.—YB
Berkeley Scientific Corp., Div. of Beckman Instruments, Inc., 2200 Wright Ave., Richmond, Calif.—YB
Bogue Railway Equipment Div., Bogue Electric Mfg. Co., 52 Iowa Ave., Paterson 5, N. J.—YA
Bone Engineering Corp., 701 W. Broadway, Glendale 4, Calif.—YB
Bowmar Instrument Corp., Smith Municipal Airport, Fort Wayne, Ind.—YA
Brush Development Co., The, 3405 Perkins Ave., Cleveland 14, Ohio—YB
Bunnel & Co., 81 Prospect St., Bklyn, N. Y.—YA, YB
Burnell & Co., 45 Warburton, Yonkers 2, N. Y.—YB
Cardwell Mfg. Co., Allen D., Plainville, Conn.—YA
Clarke Instruments, 919 Jesup-Blair Dr., Silver Spring, Md.—YB
Cook Electric, 2700 Southport, Chicago, Ill.—YA
Daco Machine, 202 Tillary, Bklyn 1, N. Y.—YA
Taffet Radio & TV Co., 2530 Belmont Ave., New York 58, N. Y.—YA
Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J.—YB
Electrodyne Co., 32 Oliver St., Boston 10, Mass.—YA, YB
Electro Mechanical Research, Inc., 64 Main St., Bridgefield, Conn.—YB
Engineering Research Associates, Inc., 1902 W. Minnehaha Ave., St. Paul W4, Minn.—YA
Engineering Research & Development Co., Box 166, Hinsdale, Ill.—YA, YB
Esterline-Angus Co., Box 596, Indianapolis, Ind.—Y
Fairchild Recording Equipment Corp., 154th St. & 7th Ave., Whitestone 57, N. Y.—YB
Flader, Inc., Frederic, 583 Division St., N. Tonawanda, N. Y.—YA, YB
Ford Instrument Co., 31-10 Thomson St., Long Island City 1, N. Y.—YA, YB
Gamewell Co., The, 1238 Chestnut St., Newton Upper Falls 64, Mass.—YA
General Precision Lab., Inc., 63 Bedford Rd., Pleasantville, N. Y.—YA
Giannini & Co., Inc., G. M., 332 Springfield Ave., Summit, N. J.—YA, YB
Haledy Electronics Co., 57 William St., New York 5, N. Y.—YB
Hammarlund Mfg. Co., 460 W. 34, New York, N. Y.—YB
Hartman Engineering Co., 117 Oakland St., Springfield, Mass.—YB
Harvey-Wells Electronics, Inc., North St., Southbridge, Mass.—YB
Hillyer Instrument Co., 54 Lafayette St., New York 13, N. Y.—YA
Hycor Co., 11423 Vanowen, N. Hollywood, Calif.—YB
Industrial Control Co., Straight Path & Arlington Ave., Wyandanch, L. I., N. Y.—YA
Industrial Elect. Engrs., 3973 Lankershim, N. Hollywood, Calif.—YA, YB
International Research Associates, Div. of Iresco Inc., 2221 Warwick Ave., Santa Monica, Calif.—YB
International Telemeter Corp., 200 Stoner Ave., Los Angeles 25, Calif.—YB
Ionic Electronic Equipment Co., 1705 N. Kenmore, Los Angeles 27, Calif.—YB
Kalbfell Laboratories, Inc., P. O. Box 1578, San Diego 10, Calif.—YA
Ketay Mfg. Corp., 555 B'way, New York, N. Y.—Y
Kinetix Instrument Co., 902 Broadway, New York 10, N. Y.—YA, YB
Leopold & Stevens Instruments, 4445 N. E. Glisan St., Portland 13, Ore.—YA, YB
Librascope, Inc., 1607 Flower, Glendale, Calif.—YA
Loral Electronics Corp., 794 E. 140 St., New York 54, N. Y.—YA
Low-Bar Products, 938 Pico, Santa Monica, Calif.—YA
Magnetic Amplifiers, Inc., 632 Tinton Ave., New York 55, N. Y.—YA
Magnetic Devices Corp., 103 S. Van Brunt St., Englewood, N. J.—YA
Mark Products Co., 3547-49 Montrose Ave., Chicago 18, Ill.—YA
Melpar, Inc., 452 Swann, Alexandria, Va.—YA, YB
Midwestern Geophysical Lab., 3401 S. Harvard Ave., Tulsa, Okla.—YA
Moseley, Francis L., 1136 N. Las Palmas, Los Angeles 38, Calif.—YA
Motorola, Inc., 4545 Augusta Blvd., Chicago 51, Ill.—YB
Pacific Mercury Television Mfg. Corp., 5955 Van Nuys Blvd., Van Nuys, Calif.—YB
Parsons Co., The Ralph M., 689 S. Fair Oaks Ave., Pasadena 2, Calif.—YB
Pederson Electronics, Box 572, Lafayette, Calif.—YA
Radio Corp. of America, RCA-Victor Div., Camden, N. J.—YB
Radio Laboratories, Inc., 1846 Westlake North, Seattle 9, Wash.—YB
Rahm Instruments, Inc., 12 W. Broadway, New York 7, N. Y.—YB
Reeves Instrument, 215 E. 91 St., New York 28, N. Y.—YA
Resdel Engineering Corp., 2351 Riverside Dr., Los Angeles 39, Calif.—YA, YB
Robinette Co., W. C., 802 Fair Oaks Ave., S. Pasadena, Calif.—YA
Rosen Engineering Products, Inc., Raymond, 32 & Walnut Sts., Philadelphia 4, Pa.—YB
Rowe Industries, 1702 Wayne, Toledo 9, Ohio—YA, YB
Seaboard Electric Co., 417 Canal St., New York 13, N. Y.—YA
Servo Corp. of America, 2020 Jericho Turnpike, New Hyde Park, N. Y.—YA, YB
Servomechanisms, Inc., Post & Stewart Aves., Westbury, N. Y.—YA, YB
Servo-Tek Products Co., 4 Godwin Ave., Paterson 1, N. J.—YA, YB
Skiatron Electronics & Television Corp., 30 E. 10th St., New York 3, N. Y.—YA, YB
Slate & Associates, Claude C., 11370 W. Olympic Blvd., Los Angeles 64, Calif.—TA
Special Instruments Laboratory, Inc., 1003 Highland Ave., Knoxville, Tenn.—YA
Square Root Mfg. Co., 391 Saw Mill River Rd., Yonkers 2, N. Y.—YA, YB
Standard Electronic Research Corp., 2 East End Ave., New York 21, N. Y.—YA
Streeter-Amet Co., 4101 Ravenswood Ave., Chicago 13, Ill.—YB
Sylvania Electric Products, Inc., 1740 Broadway, New York 19, N. Y.—YB
Telemetering Associates, Box 6, Silver Spring, Md.—YB
Transicoil Corp., 107 Grand St., New York, N. Y.—YA
Transmitter Equipment Mfg. Co., 345 Hudson St., New York 14, N. Y.—YA, YB
Trans-Sonics, Inc., Bedford, Mass.—YA, YB
Vectron, Inc., 235 High St., Waltham, Mass.—YA
Wang Laboratories, 296 Columbus Ave., Boston 16, Mass.—YB

TEST EQUIPMENT SALES*

Jan.—Sept. 1952

	Units	Mfr. Billing
Signal generators and test oscillators	8,684	$1,952,888.79
VTVM and combination meters	36,929	$1,480,019.61
Cathode-ray oscillographs	9,414	$2,791,682.18
Tube testers	9,408	$ 813,912.39
Impedance measuring equipment	1,111	$ 523,400.00
Electronic power supplies	901	$ 91,476.00
Miscellaneous	11,390	$3,311,016.61
TOTAL	77,837	$10,964,395.58

* Information supplied

25—Connectors & Cable

Cable accessories . . . . ZA
Cable connectors . . . . ZB
Cable markers . . . . ZC
Coaxial cable . . . . ZD
Coaxial switches . . . . ZE
Jack panels . . . . ZF
Jacks, telephone & microphone . . . ZG
Junction boxes . . . . ZH
Microphone connectors . . . . ZI
Patch cords . . . . ZJ
Plugs . . . . ZK
Power connectors . . . . ZL
Reels, cable . . . . ZM
Shielded cable . . . . ZN
Terminals . . . . ZO

Advance Insulated Wire & Cable Co., 72 Woolsey St., Irvington 11, N. J.—ZD, ZN
Aeronautical Radio Mfg. Co., 155 First St., Mineola, N. Y.—ZK
Aircraft-Marine Products Inc., 2100 Paxton St., Harrisburg, Pa.—ZA, ZJ
Airplane & Marine Instruments, Clearfield, Pa.—ZI
Alden Products Co., 123 N. Main St., Brockton 64, Mass.—ZB
Alpha Wire Corp., 430 Broadway, New York 13, N. Y.—ZD, ZM, ZN
American Electric Cable Co., 181 Appleton St., Holyoke, Mass.—ZN
American Phenolic Corp., 1830 S. 54 Ave., Chicago 50, Ill.—ZA, ZB, ZD, ZI, ZK, ZL, ZN
American Radio Hardware Co., 152 Mac Questen Pky., So., Mt. Vernon, N. Y.—ZA, ZB, ZC, ZG, ZJ, ZK
Anaconda Wire & Cable Co., 25 Broadway, New York 4, N. Y.—ZA, ZB, ZD, ZN
Andrew Corp., 363 E. 75 St., Chicago 20, Ill.—ZD, ZF, ZI
Ansonia Electrical Co., The, 65 Main St., Ansonia, Conn.—ZD, ZN
Assoc. Eng'g. Corp. of Boston, 38 Euston Rd., Brighton 35, Mass.—ZJ, ZK
Audio Development Co., 2833 13 Ave. S., Minneapolis 7, Minn.—ZF, ZG, ZJ, ZK
Audio & Video Products Corp., 730 Fifth Ave., New York 19, N. Y.—ZF, ZG, ZI, ZJ, ZK, ZL
Automatic Electric Co., 1033 W. Van Buren St., Chicago 7, Ill.—ZG, ZK
Bardwell & McAllister, 2950 N. Ontario St., Burbank, Calif.—ZA
Beam Instruments Corp., 350 Fifth Ave., New York 1, N. Y.—ZD, ZM, ZN
Belden Mfg. Co., 4647 W. VanBuren St., Chicago 44, Ill.—ZD, ZN
Bendix Aviation Corp., Scintilla Magneto Div., Sidney, N. Y.—ZB
Bird Electronic Corp., 1800 E. 38th St., Cleveland 14, Ohio—ZD
Birnbach Radio Co., 145 Hudson, New York, N. Y.—ZN
Brady Co., W. H., 1678 E. Spring St., Milwaukee 3, Wisc.—ZC
Brand & Co., William, The. North & Valley Sts., Willimantic, Conn.—ZC, ZD, ZN
Breeze Corporations, Inc., 41 S. Sixth St., Newark 7, N. J.—ZB
Brookhaven Electronics, Box 931, Sanford, N. C.—ZH
Bud Radio, Inc., 2118 E. 55th, Cleveland, Ohio—ZH
Buggie & Co., H. H., 726 Stanton St., Toledo 1, Ohio—ZA, ZB, ZF, ZJ, ZK
Camburn, Inc., 32-40 57 St., Woodside, N. Y.—ZA, ZB
Camera Equipment Co., 1600 Broadway, New York 19, N. Y.—ZA, ZB, ZK, ZL
Camfield Mfg. Co., Seventh St., Grand Haven, Mich.—ZB, ZE, ZH, ZL
Cannon Electric Co., 3209 Humboldt St., Los Angeles 31, Calif.—ZB, ZG, ZI, ZK, ZL
Capitol Stage Lighting Co., 527-529 W. 45 St., New York 36, N. Y.—ZA, ZB, ZK
Carter Parts Co., 213 Institute Place, Chicago 10, Ill.—ZG, ZK
Chase Brass & Copper, 236 Grand St., Waterbury 20, Conn.—ZD, ZN
Chester Cable Corp., Chester, N. Y.—ZD, ZM, ZN
Cinch Mfg. Corp., 1026 S. Homan Ave., Chicago 24, Ill.—ZB
Cinema Engineering Co., 1510 W. Verdugo Ave., Burbank, Calif.—ZF, ZG, ZI
Circle Mfg. Co., Box 152, Little Falls, N. J.—ZB
Coleman Cable & Wire Corp., 4515 W. Addison St., Chicago 41, Ill.—ZD, ZH
Columbia Technical Corp., 5 E. 57 St., New York 22, N. Y.—ZD
Columbia Wire & Supply Co., 2850 Irving Park Rd., Chicago 18, Ill.—ZD, ZL, ZM, ZN
Communication Products Co., Marlboro, N. J.—ZD
Conn. Telephone & Electric, 70 Britannia St., Meriden, Conn.—ZC, ZF, ZG, ZH, ZI, ZK
Co-Operative Industries, Inc., 100 Oakdale Rd., Chester, N. J.—ZJ, ZN
Commercial Plastics Co., Merchandise Mart, Chicago 54, Ill.—ZA
Crouse-Hinds Co., Wolf & 7 North Sts., Syracuse 1, N. Y.—ZH, ZK, ZL
Curtis Development & Mfg. Co., 3266 N. 33 St., Milwaukee 16, Wisc.—ZO
Dage Electronics Corp., 69 N. Second St., Beech Grove, Ind.—ZB
DeJur-Amsco Corp., 45-01 Northern Blvd., at 45th St., Long Island City 1, N. Y.—ZB, ZK, ZL
Dial Light Co. of America Inc., 900 Broadway, New York 3, N. Y.—ZI, ZN
Diamond Mfg., 7 North Ave., Wakefield, Mass.—ZB
Diamond Wire & Cable Co., 380 Harvester St., Sycamore, Ill.—ZN
Dielectric Materials Co., 5315-17 N. Ravenswood Ave., Chicago 40, Ill.—ZD, ZN
Dittmore & Freimuth Co., 251 7E Norwich St., Cudahy, Wisc.—ZA, ZB, ZC, ZE, ZF, ZG, ZH, ZI, ZK, ZL
Eagle Electric Mfg. Co., 23-10 Bridge Plaza S., Long Island City 1, N. Y.—ZA, ZB, ZC, ZH, ZJ, ZK, ZL, ZM, ZN
Eby, Inc., Hugh H., 4700 Stenton Ave., Philadelphia 44, Pa.—ZK
Elco Corp., 190 W. Glenwood Ave., Philadelphia 40, Pa.—ZB, ZK, ZL
Electrical Industries, Inc., 44 Summer Ave., Newark 4, N. J.—ZO
Electronic Development Lab., 43-07 23 Ave., Long Island City 5, N. Y.—ZF, ZJ, ZK
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Equipment & Service Co., 6815 Oriole Dr., Dallas 9, Tex.—ZA, ZB, ZF, ZG, ZH, ZI, ZJ, ZK, ZL
Everlast Wire & Cable Co., 12 Maple Ave., Haverstraw, N. Y.—ZD, ZN
Gates Radio Co., 123 Hampshire St., Quincy 1, Ill.—ZA, ZD, ZE, ZF, ZG, ZI, ZK, ZN
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General Communication Co., 681 Beacon St., Boston 15, Mass.—ZE
General Insulated Wire Works, Inc., 69 Gordon Ave., Providence 5, R. I.—ZD, ZN
General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass.—ZB, ZD, ZJ, ZK
General RF Fittings Co., 702 Beacon St., Boston 15, Mass.—ZB, ZF, ZK
Globe Electrical & Mfg., 11019 Buford Ave., Inglewood, Calif.—ZO
Hallett Mfg. Co., 1601 W. Florence Ave., Inglewood, Calif.—ZA, ZB, ZK, ZN
Hall Inc., F. Sumner, 153 W. 33 St., New York 1, N. Y.—ZF, ZG, ZJ, ZK
Hermetic Seal Products, 33 S. 6 St., Newark 7, N. J.—ZO
Holub Industries, 413 DeKalb Ave., Sycamore, Ill.—ZA, ZB
Industrial Electrical Works, 1509 Chicago St., Omaha 2, Nebr.—ZM
Industrial Power & Equipment Co., 225 Broadmoor Ave., Pittsburgh 34, Pa.—ZL
Industrial Products Co., Danbury, Conn.—ZA, ZB, ZD, ZE
Javex, Garland, Tex.—ZK
Johnson Co., E. F., Waseca, Minn.—ZG
Jones Div., Howard B., Cinch Mfg. Corp., 1026 S. Homan Ave., Chicago 24, Ill.—ZB, ZG, ZK, ZL, ZO
Joy Mfg. Co., Electrical Connector Div., 4235 Clayton Ave., St. Louis 10, Mo.—ZB
Kellogg Switchboard & Supply Co., 6650 S. Cicero Ave., Chicago 38, Ill.—ZF, ZG, ZH, ZI, ZN
Key Electronics Corp., 20 W. 22 St., New York 10, N. Y.—ZF, ZH
Keystone Electronics Corp., 423 Broome St., New York 13, N. Y.—ZF
Kinevox Inc., 116 S. Hollywood Way, Burbank, Calif.—ZB, ZI, ZJ, ZK, ZL
Kings Eletronics Inc., 50 Marbledale Ave., Tuckahoe, N. Y.—ZB
Knickerbocker Annunciator Co., 75 Murray St., New York 7, N. Y.—ZH
Kolton Electric Mfg. Co., 123 N. J. Railroad Ave., Newark 5, N. J.—ZB, ZH
Kulka Electric Mfg. Co., Inc., 633 S. Fulton Ave., Mount Vernon, N. Y.—ZH
Lenz Electric Mfg. Co., 1751 Western Ave., Chicago 47, Ill.—ZN
Leonard Electric Products Co., 67 34 St., B'klyn, N. Y.—ZH
Magna Electronics Co., Inglewood, Calif.—ZA, ZB
Mallory & Co., P. R., [illegible] E. Washington St., Indianapolis [illegible], Ind.—ZG, ZK
Mark Products Co., 5747 19 Montrose Ave., Chicago 18, Ill.—ZD, ZE
Mendelsohn Speedgun, 457 Bloomfield Ave., Bloomfield, N. J.—ZB
Millen Mfg. Co., James, 150 Exchange St., Malden 48, Mass.—ZN, ZL
Neptune Electronics Co., [illegible] Broadway, New York 13, N. Y.—ZA, ZB, ZF, ZH, ZI, ZK, ZL
New London Instrument Co., P. O. Box 189, New London, Conn.—ZA
North Electric Mfg. Co., 501 S. Market St., Galion, Ohio—ZF, ZG
O'Brien Electric Co., [illegible] Santa Monica Blvd., Hollywood 38, Calif.—ZF, ZJ, ZK
Okonite Co., The, Passaic, N. J.—ZD, ZN
Orthon Corp., 196 Albion Ave., Paterson, N. J.—ZH
Pacific Electricord Co., 3217 Exposition Pl., Los Angeles 18, Calif.—ZA, ZB, ZG, ZK
Permoflux Corp., 4900 W. Grand Ave., Chicago 39, Ill.—ZI, ZK
Pfleger Products, 3901 W. 54, Los Angeles, Calif.—ZO
Phalo Plastics Corp., 25 Foster St., Worcester 4, Mass.—ZD, ZN
Phelps Dodge Copper Products, 40 Wall St., New York 5, N. Y.—ZD
Philmore Mfg. Co., 113 University Pl., New York 3, N. Y.—ZG, ZI, ZN
Plastic Wire & Cable Corp., E. Main St., Jewett City, Conn.—ZD, ZN
Plastoid Corp., Hamburg, N. J.—ZD, ZN
Precision Tube Co., Church Rd. & Wissahickon, N. Wales, Pa.—ZD
Product Development Co., 307 Bergen Ave., Kearny, N. J.—ZD
Radio Corp. of America, RCA-Victor Div., Camden, N. J.—ZA, ZB, ZD, ZE, ZF, ZG, ZH, ZI, ZJ, ZK, ZL, ZM, ZN
Radio Essentials, Inc., 152 Mac Questen Pkwy. S., Mount Vernon, N. Y.—ZA, ZB, ZC, ZF, ZG, ZI, ZJ, ZK
Red Arrow Electronics, Inc., 420 Alden St., Orange, N. J.—ZA, ZB, ZG, ZH
Remler Co., 2102 Bryant St., San Francisco 10, Calif.—ZB, ZG, ZI, ZK, ZL
Roanwell Corp., 662 Pacific St., Brooklyn 17, N. Y.—ZK
Rockbestos Products Corp., 285 Nicoll St., New Haven 4, Conn.—ZD, ZN
Rome Cable Corp., Ridge St., Rome, N. Y.—ZD, ZN
Rowe Industries, 1702 Wayne St., Toledo 9, Ohio—ZA, ZD
Runzel Cord & Wire Co., 4723-31 W. Montrose Ave., Chicago 41, Ill.—ZI, ZK, ZN
Schutter Mfg. Co., Carl W., 80 E. Montauk Highway, Lindenhurst, L. I., N. Y.—ZB, ZD, ZE
Shaw Insulator, 160 Coit St., Irvington, N. J.—ZO
Sherman Mfg. Co., 22 Barnes St., Battle Creek, Mich.—ZB
Sound Sales & Engineering Co., 2005 La Branch, Houston 3, Tex.—ZA, ZB, ZD, ZF, ZG, ZH, ZI, ZJ, ZK, ZN
Star Expansion Products Co., 147 Cedar St., New York 6, N. Y.—ZK
Stromberg-Carlson Co., 1225 Clifford Ave., Rochester, N. Y.—ZG, ZH, ZI
Switchcraft, Inc., 1328-30 N. Halsted St., Chicago 22, Ill.—ZG, ZI, ZK
Telectro Industries Corp., 35-18 37 St., Long Island City 1, N. Y.—ZA, ZF, ZG, ZH, ZI, ZJ, ZM
Teletronic Laboratories, Inc., 1835 W. Rosecrans Ave., Gardena, Calif.—ZC
Tensolite Insulated Wire Co., Tarrytown, N. Y.—ZD, ZN
Thompson Products, Inc., 2196 Clarkwood Rd., Cleveland 3, Ohio—ZE
Topflight Tape Co., 52 S. Duke St., York, Pa.—ZC
Transco Products, 12210 Nebr. Ave., Los Angeles 25, Calif.—ZE
Trimm, Inc., 400 W. Lake St., Libertyville, Ill.—ZF, ZG, ZI, ZK
T-V Products Co., 152 Sanford St., Brooklyn 5, N. Y.—ZA, ZE, ZG, ZH, ZJ
U. S. Rubber Co., 1230 Ave. of the Americas, New York 20, N. Y.—ZD, ZK, ZN
U. S. Wire & Cable Co., 27 Haynes Ave., Newark, N. J.—ZD
Universal Microphone Co., 424 Warren Lane, Inglewood 3, Calif.—ZK
Univox Corp., 83 Murray St., New York 7, N. Y.—ZD, ZH
Vector Electronic Co., 3352 San Fernando Rd., Los Angeles 65, Calif.—ZE
Wadsworth Mfg. Associates, 509 Balsam St., Liverpool, N. Y.—ZF
Ward Products Corp., Div. of The Gabriel Co., 1523 E. 45 St., Cleveland 3, Ohio—ZB
Weckesser Co., 5261 N. Avondale Ave., Chicago 30, Ill.—ZA
Western Insulated Wire Co., 2425 E. 39 St., Los Angeles, Calif.—ZH
Whitney Blake Co., 1565 Dixwell Ave., Hamden 14, Conn.—ZD, ZJ, ZN

26—Audio Equip.-General

Bass units . . . . AAA
Earphones . . . . AAB
HiFi loudspeaker . . . . AAC
Loudspeakers . . . . AAD
Shielding . . . . AAE
Sound treatment . . . . AAF
Special baffles & forms . . . . AAG
Tweeters . . . . AAH

Altec Lansing Corp., 9356 Santa Monica Blvd., Beverly Hills, Calif.—AAA, AAB, AAC, AAD, AAG, AAH
Atlas Sound Corp., 1449 39 St., Brooklyn 18, N. Y.—AAC, AAD, AAG, AAH
Audicraft Inc., 77 S. 5th St., B'klyn, N. Y.—AAD
Audio & Video Products Corp., 730 Fifth Ave., New York 19, N. Y.—AAA, AAB, AAC, AAD, AAH
Beam Instruments Corp., 350 Fifth Ave., New York 1, N. Y.—AAA, AAC, AAD
Bendix Radio Div., Bendix Aviation Corp., Baltimore 4, Md.—AAB
Best Mfg. Co., 1200 Grove St., Irvington 11, N. J.—AAB, AAD
Bogen Co., D., 29 9th Ave., New York 14, N. Y.—AAG
Bozak Co., R. T., 90 Montrose Ave., Buffalo 14, N. Y.—AAC, AAH
Brociner Electronics Laboratory, 1546 Second Ave., New York 28, N. Y.—AAA, AAC, AAD, AAG
Brush Development Co., The, 3405 Perkins Ave., Cleveland 14, Ohio—AAB
Cannon Co., C. F., Springwater, N. Y.—AAB
Carbonneau Industries, 21 Ionia N. W., Grand Rapids 2, Mich.—AAC, AAD
Celotex Co., 120 S. LaSalle St., Chicago, Ill.—AAF
Cleveland Electronics, Inc., 6611 Euclid Ave., Cleveland 3, Ohio—AAC, AAD, AAH
Conn. Telephone & Electric, 70 Britannia St., Meriden, Conn.—AAB
Co-Operative Industries, Inc., 100 Oakdale Road, Chester, N. J.—AAF
C-S Mfg. Co., 1059 Lincoln Blvd., Venice, Calif.—AAD
Delco Radio Div., General Motors Corp., Kokomo, Ind.—AAD
Dukane Corp., 110 N. 11 St., St. Charles, Ill.—AAD
D X Radio Products Co., 2300 W. Armitage Ave., Chicago 47, Ill.—AAD
Dyna-Labs Inc., 1075 Stewart Ave., Garden City, L. I., N. Y.—AAB
Electronic Development Laboratory, 43-07 23 Ave., Long Island City 5, N. Y.—AAA, AAC, AAD, AAG, AAH
Electro-Voice, Inc., Cecil & Carroll Sts., Buchanan, Mich.—AAA, AAB, AAC, AAD, AAG, AAH
General Electric Co., Electronics Div., Electronics Park, Syracuse, N. Y.—AAC, AAD
Gelton Mfg. Corp., 212 Durham Ave., Metuchen, N. J.—AAB, AAH
Hallett Mfg. Co., 1601 W. Florence Ave., Inglewood, Calif.—AAE
Heppner Mfg. Co., Round Lake, Ill.—AAD
Holt Audio Industries, 5014 N. Encinita Ave., Temple City, Calif.—AAD
Jensen Mfg. Co., 6601 S. Laramie Ave., Chicago 38, Ill.—AAC, AAD, AAH
Johns-Manville Corp., Acoustical Dept., 20 E. 40 St., New York, N. Y.—AAF
Kimberley-Clark Corp., Insulation Div., Neenah, Wisc.—AAF
Klipsch & Associates, Hope, Ark.—AAC
Kupfrain Mfg. Co., Box 714, Binghamton, N. Y.
Lansing Sound, Inc., James B., 2439 Fletcher Dr., Los Angeles 39, Calif.—AAA, AAC, AAD, AAG, AAH
Lowell Mfg. Co., 1531 Branch St., St. Louis 7, Mo.—AAD, AAG
Magna Electronics Co., Inglewood, Calif.—AAG
Magnavox Co., Bueter Rd., Ft. Wayne 4, Ind.—AAD
Millen Mfg. Co., James, 150 Exchange St., Malden 48, Mass.—AAE
Multi-Metal Co., 1352 Garrison Ave., New York 59, N. Y.—AAE
Murdock Co., 158 Carter St., Chelsea, Mass.—AAB
Muter Co., The, 1255 S. Michigan Ave., Chicago 5, Ill.—AAC, AAD, AAH
National Gypsum Co., 325 Delaware Ave., Buffalo, N. Y.—AAF

Olesen Co., Otto K., 1534 Cahuenga Blvd., Hollywood 28, Calif.—AAD
Oregon Corvek Co., 1005 N. W. 16 Ave., Portland 9, Ore.—AAG
Oxford Electric Corp., 3911 S. Michigan Ave., Chicago 15, Ill.—AAD
Perfection Electric Co., 2635 S. Wabash, Chicago, Ill.—AAD
Permoflux Corp., 4900 W. Grand Ave., Chicago 39, Ill.—AAB, AAC, AAD, AAG
Philmore Mfg. Co., 113 University Pl., New York 3, N. Y.—AAB, AAD
Quam-Nichols Co., 526 E. 33 Place, Chicago 16, Ill.—AAA, AAC, AAD, AAH
Racon Electric Co., Inc., 52 E. 19 St., New York 3, N. Y.—AAD
Radio Corporation of America, RCA-Victor Div., Camden, N. J.—AAG
Radio Corporation of America, RCA Tube Dept., Harrison, N. J.—AAC, AAD
Radio-Music Corp., 84 South Water St., Port Chester, N. Y.—AAC, AAD
Roanwell Corp., 662 Pacific St., Brooklyn 17, N. Y.—AAB
Rowe Industries, 1702 Wayne St., Toledo 9, Ohio—AAA, AAC
Shrader Mfg. Co., 2803 M St., N. W., Washington, D. C.—AAG
Shura-tone Products, Inc., 440 Adelphi St., Brooklyn 17, N. Y.—AAG

Sisalkraft Co., 205 W. Wacker Dr., Chicago 6, Ill.—AAE
Sonotone Corp., Box 200, Elmsford, N. Y.—AAB
S.O.S. Cinema Supply, 602 W. 52 St., New York 19, N. Y.—AAC, AAD, AAG, AAH
Sound Laboratories, 322 E. 48 St., New York 17, N. Y.—AAG
Sound Sales & Engineering Co., 2005 La Branch, Houston 2, Tex.—AAA, AAB, AAC, AAD, AAE, AAF, AAG, AAH
Stephens Mfg. Corp., 8538 Warner Drive, Culver City, Calif.—AAC, AAD, AAG, AAH
Stromberg-Carlson Co., 1225 Clifford Ave., Rochester, N. Y.—AAC, AAD, AAH
Tape Recording Industries, 2535 E. Michigan Ave., Lansing, Mich.—AAA, AAB, AAC, AAD, AAH
Telemarine Communications Co., 536 W. 27 St., New York 1, N. Y.—AAH
Telex, Inc., Telex Park, St. Paul, Minn.—AAB
Trimm, Inc., 400 W. Lake, Libertyville, Ill.—AAB
U. S. Gypsum Co., 300 W. Adams St., Chicago 6, Ill.—AAB
U. S. Recording Co., 1121 Vermont Ave., N. W., Washington 5, D. C.—AAC, AAD
University Loudspeakers, Inc., 80 S. Kensico Ave., White Plains, N. Y.—AAA, AAC, AAD, AAH
Utah Radio Products Co., 1123 E. Franklin St., Huntington, Ind.—AAA, AAC, AAD, AAF, AAG, AAH
Wright Zimmerman, Inc., 330 5th Ave., New Brighton 8, Minn.—AAB, AAC, AAD

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TECHNICAL INDEX

SELECTING THE PROPER LOUDSPEAKER SYSTEM .... Page 4
METHODS OF CONNECTING SPEAKERS TO THE AMPLIFIER .... Page 8
IMPEDANCE MATCHING .... Page 9
CONSTANT VOLTAGE DISTRIBUTION SYSTEM .... Page 12
IMPEDANCE MATCHING TRANSFORMERS .... Page 16
EFFECTS OF MISMATCH UPON POWER TRANSFER .... Page 16
CONTROLLING LOUDSPEAKER VOLUME .... Page 20
OVERLOAD PROTECTION OF LOUDSPEAKERS .... Page 22
PHASING LOUDSPEAKERS .... Page 23
REVERBERATION .... Page 23
BAFFLING A CONE SPEAKER .... Page 26

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Bridges, resistance	BBI
Cameras, osciloscope recording	BBJ
Design, custom	BBK
Detector, vacuum leak	BBL
Generators, AM	BBM
FM	BBN
TV	BBO
composite TV signal	BBP
grating	BBQ
microwave signal	BBR
noise	BBS
pulse	BBT
signal	BBU
square wave	BBV
sweep	BBW
timing marker	BBX
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Instruments, special laboratory	BCA
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Meters, crystal impedance	BCC
Meters, distortion and noise	BCD
frequency	BCE
grid dip	BCF
output power	BCG
phase	BDA
power level	BDC
sound level	BCH
vibration	BCI
wow and flutter	BCJ
Microvolter, audio frequency	BCK
Noise diodes	BCL
Oscillators, audio	BCM
Oscillators, UHF	BCN
Oscilloscopes	BCO
Records, frequency test	BCP
Sets, field strength measuring	BCQ
insulation test	BCR
sound level measuring	BCS
transmission measuring	BCT
Standards, frequency	BCU
Stroboscope	BCV
Testers, tube	BCW
Voltmeters, vacuum tube	BCX
Volt-ohm-milliammeters	BCY
Units, decade inductor	BCZ

Acorn Electronics Corp., Box 348, Gibson City, Ill.—BBA
Advance Electronics Co., Box 394, Passaic, N. J.—BBA, BBT, BBV
Aerocoil, Inc., 507 26 St., Union City, N. J.—BBU, BBZ, BCE, BCF, BCG, BCN
Aero Electronics Co., 1512 N. Wells St., Chicago 10, Ill.—BBA, BBK, BBY, BCA
Aero-Sonic Mfg., 2015 Pontius Ave., Los Angeles 25, Calif.—BBK
Aircraft Electronics Assoc., 94 Silas Dean Highway, Rocky Hill, Conn., BBK, BCA
Aircraft Radio Corp., Boonton, N. J.—BBI
Airlectron, Inc., Caldwell, N. J.—BCO, BCX
Altec Lansing Corp., 9356 Santa Monica Blvd., Beverly Hills, Calif.—BBA
American Chronoscope Corp., 316 W. First St., Mount Vernon, N. Y.—BCX, BCY
American Electroneering Corp., 5025 W. Jefferson Blvd., Los Angeles 16, Calif.—BBA, BBD, BBM, BBR, BBU, BCN, BCQ
American Television, Inc., 5050 Broadway, Chicago, Ill.—BBO, BBP, BBV, BBW, BCO
American Time Products, Inc., 580 Fifth Ave., New York 19, N. Y.—BCU
Amplifier Corp. of America, 398 Broadway, New York 13, N. Y.—BBA
Ansley Electronics, Inc., 85 Tremont St., Meriden, Conn.—BBA, BBB
Antenna Research Laboratory, 797 Thomas Lane, Columbus 14, Ohio—BBA
Applied Science Corp. of Princeton, Box 44, Princeton, N. J.—BBT, BCA
Approved Electronic Instrument Corp., 928 Broadway, New York 10, N. Y.—BBM, BBN, BBO, BBU, BBW, BCQ
ARF Prods., Inc., 7627 W. Lake St., River Forest, Ill.—BBN, BBW
Associated Research, Inc., 3758 W. Belmont Ave., Chicago 18, Ill.—BCA, BCR
Atlantic Electronics Corp., 4 Manhasset Ave., Port Washington, N. Y.—BBA, BBK, BBS, BBT, BBV, BBX, BCN
Audio Instrument Co., 133 W. 14 St., New York 11, N. Y.—BBA, BBK, BBY, BCA, BCD, BCS, BCT
Audio-Tone Oscillator Co., 237 John St., Bridgeport 3, Conn.—BCM

NEW! FOR VHF-UHF

PRD type 907 sweep frequency generator

FREQUENCY RANGE:
35 TO 900 MEGACYCLES

•

MINIMUM OUTPUT VOLTAGE:
1 VOLT

•

DIRECT READING FREQUENCY DIAL:
CONTINUOUSLY VARIABLE

•

OUTPUT IMPEDANCE:
75 OHMS-BNC CONNECTOR

•

MINIMUM SWEEP WIDTH ABOVE 60 MC/S:
20 MC/S

The Type 907 is a fundamental oscillator which can be swept in frequency over a band of not less than 10 mc/s for a center frequency of 35 mc/s. The sweep width is greater than 20 mc. for carrier frequencies above 60 mc/s. Output is continuously variable over a voltage range of 10 microvolts to 1 volt. Other features include a video blanking circuit for providing a true horizontal zero base line and a terminal for inserting external frequency markers.

For further information concerning this instrument and additional UHF-VHF equipment, address inquiries to Dept. T-10

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Laboratory Standards

Model 65-B

Model 78-FM

Model 80

STANDARD SIGNAL GENERATORS

MODEL	FREQUENCY RANGE	OUTPUT RANGE
65-B	75 Kc.-30 Mc.	0.1 microvolt to 2.2 volts
78	15-25 Mc.; 195-225 Mc. 15-25 Mc.; 90-125 Mc. other ranges on order	1 to 100,000 microvolts
78-FM	86 Mc.-108 Mc.	1 to 100,000 microvolts
80	2 Mc.-400 Mc.	0.1 to 100,000 microvolts
82	20 cycles to 200 Kc. 80 Kc. to 50 Mc.	0-50 volts 0.1 microvolt to 1 volt
84	300 Mc.-1000 Mc.	0.1 to 100,000 microvolts
90	20 Mc.-250 Mc.	0.3 microvolt to 0.1 volt

U.H.F. OSCILLATOR

MODEL	FREQUENCY RANGE	OUTPUT RANGE
112	300 Mc. – 1000 Mc.	Maximum varies between 0.3 volt and 2 volts. Adjustable over 40 db range.

SQUARE WAVE GENERATOR

MODEL	FREQUENCY RANGE	WAVE SHAPE
71	Continuously variable 6 to 100,000 cycles	Rise time less than 0.2 microseconds with negligible overshoot

U.H.F. RADIO NOISE and FIELD STRENGTH METER

MODEL	FREQUENCY RANGE	INPUT VOLTAGE RANGE
58	15 Mc. to 150 Mc.	1 to 100,000 microvolts in antenna. 1 to 100 microvolts on semi-logarithmic output meter, balanced resistance attenuator with ratios of 10, 100 and 1000 ahead of all tubes.

MEGACYCLE METER

MODEL	FREQUENCY RANGE	MODULATION
59	2.2 Mc.–400 Mc. FREQUENCY ACCURACY Within ±2%	CW or 120 cycles fixed at approximately 30%. Provision for external modulation

CRYSTAL CALIBRATOR

MODEL	FREQUENCY RANGE	HARMONIC RANGE
111	250 Kc. – 1000 Mc. FREQUENCY ACCURACY ±0.002%	.25 Mc. Oscillator: .25-450 Mc. 1 Mc. Oscillator: 1-600 Mc. 10 Mc. Oscillator: 10-1000 Mc.

VACUUM TUBE VOLTMETERS

MODEL	VOLTAGE RANGE	FREQUENCY RANGE
62	0-1, 0-3, 0-10, 0-30 and 0-100 volts AC or DC	30 cycles to over 150 Mc.
62-U.H.F.	0-1, 0-3, 0-10, 0-30 and 0-100 volts AC or DC	100 Kc. to 500 Mc.
67	.0005 to 300 volts peak-to-peak	5 to 100,000 sine-wave cycles per second

Model 59

Model 62

PULSE GENERATOR

MODEL	REPETITION RATE	PULSE WIDTH
79-B	60 to 100,000 pulses per second	Continuously variable from 0.5 to 40 microseconds

MEASUREMENTS CORPORATION

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Ballantine Laboratories, Inc., Fanny Road, Boonton, N. J.—BCX

Barber-Colman, 1300 Rock St., Rockford, Ill.—BRY

Barber Laboratories, Alfred W., 32-44 Francis Lewis Blvd., Flushing 58, N. Y.—BCX

Bardwell & McAlister, 2950 N. Ontario St., Burbank, Calif.—BBA, BBC, BBD, BBE, BBG, BBH, BBI, BBK, BBT, BBU, BBV, BBW, BBX, BBZ, BCA, BCM, BCN

Barker & Williamson, 237 Fairfield Ave., Upper Darby, Pa.—BCD, BCM

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Bassett, Inc., Rex, 1314 N.E. 17 Court, Ft. Lauderdale, Fla.—BBA, BBK, BBM, BCC, BCE, BCU

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Bendix Aviation Corp., Red Bank Div., Eatontown, N. J.—BBS, BCL

Berkeley Custom Electronics, 2302 Roosevelt Ave., Berkeley 3, Calif.—BBA, BBK, BCD

Berkeley Scientific Corp., Div. of Beckman Instruments, Inc., 2200 Wright Ave., Richmond, Calif.—BBT, BCA, BCE, BCI

Berkshire Laboratories, 586 Beaver Pond Road, Lincoln, Mass.—BBT, BCA, BCV

Berndt-Bach, Inc., Auricon Div., 7325 Beverley Blvd., Los Angeles 36, Calif.—BBJ

Beta Electric Corp., 333 E. 103 St., New York 29, N. Y.—BCO

Biddle Co., James G., 1316 Arch St., Philadelphia 7, Pa.—BCE

Bliss Electronic Corp., Box 123, Sussex, N. J.—BBA, BBG, BBK, BCK, BCM, BCR

Bone Engineering Corp., 701 W. Broadway, Glendale 4, Calif.—BBA, BCI

Boonton Radio Corp., Intervale Road, Boonton, N. J.—BBH, BBM, BBN, BBR, BBU, BCR

Booth Co., Arthur E., 4124 Beverly Blvd., Los Angeles 4, Calif.—BCR

Brown Electro-Measurement Corp., 4635 S. E. Hawthorne Blvd., Portland 15, Ore.—BBA, BBF, BBG, BBH, BBI

Browning Laboratories, Winchester, Mass.—BCO

Brush Development Co., The 3405 Perkins Ave., Cleveland 14, Ohio—BBA, BBB, BBG, BBH, BBI, BBY, BCA, BCD, BCE, BCH, BCM, BCX, BCY

Budelman Radio Corp., 375 Fairfield Ave., Stamford, Conn.—BCE

Burlington Instrument Co., 203 N. 3 St., Burlington, Iowa—BCH

Burnett Radio Lab., Wm. W. L., 4814 Idaho St., San Diego 16, Calif.—BCE

Calidyne Co., 751 Main, Winchester, Mass.—BCA

Canoga Corp., 5955 Sepulveda Blvd., Van Nuys, Calif.—BBK, BCA

Carbonneau Industries, 21 Ionia N. W., Grand Rapids 2, Mich.—BBK

Centralab, Div. of Globe-Union, Inc., 900 E. Keefe Ave., Milwaukee 1, Wisc.—BBA

Central Research Labs., Red Wing, Minn.—BCA

Central Scientific Co., 1700 Irving Park Road, Chicago 13, Ill.—BCO

Chase Electronics Laboratory, 128 N. Fair Oaks Ave., Pasadena 1, Calif.—BBA, BBK, BCA, BCO

Chatham Electronics Corp., 475 Washington St., Newark 2, N. J.—BBT

Chicago Industrial Instrument Co., 536 W. Elm St., Chicago 10, Ill.—BCX

Cinema Engineering Co., 1510 W. Verdugo Ave., Burbank, Calif.—BBC, BBF

Clarke Instruments, 919 Jesup-Blair Drive, Silver Spring, Md.—BBD, BCQ

Clippard Instrument Laboartory, Inc., 7350-90 Colerain Road, Cincinnati 24, Ohio—BBG, BBI, BCY

Clough-Brengle Co., The, 6014 Broadway, Chicago 40, Ill.—BBG, BBI, BBM, BBU, BCM, BCT

Coastwise Electronics Co., 322 N. Foothill Rd., Beverly Hills, Calif.—BBU

Cole Instrument Co., 1320 S. Grand Ave., Los Angeles 15, Calif.—BCX

Coleman Instruments, Inc., 318 Madison St., Maywood, Ill.—BCA

Columbus Electronics Corp., 229 S. Waverly St., Yonkers, N. Y.—BCA

Communication Measurements Lab., 120 Greenwich St., New York 6, N. Y.—BBK, BBM, BCV

Communications Co., 300 Greco Ave., Coral Gables 34, Fla.—BCG, BCQ

Conn Ltd. C. G. Electronics Div., Jackson Blvd., Elkhart, Ind.—BCF

Conn. Telephone & Electric, 70 Britannia St., Meriden, Conn.—BBK, BBU, BCG, BCM, BCT

Consolidated Engineering Corp., 300 N. Sierra Madre Villa, Pasadena 15, Calif.—BBL, BBY, BCI

Constable Eng'g Co., J. M., 101 05 77 St., Ozone Park 17, N. Y.—BBK

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Electro Mechanical Research, Inc., 84 Main St., Ridgefield, Conn.—BBA, BBV

Electronic Development Laboratory, 43-07 23 Ave., Long Island City 5, N. Y.—BBA, BBH, BBK

Electronic Instrument Co., Inc., 84 Withers St., Brooklyn 11, N. Y.—BBF, BBG, BBI, BBM, BBN, BBO, BBI, BBV, BBW, BCO, BCW, BCX, BCY

Electronic Measurements Corp., 280 Lafayette St., New York 12, N. Y.—BBM, BBI, BCO, BCW, BCX, BCY

Electronic Signal Co., 541 Willis Ave., Williston Park, N. Y.—BCA

Electronic Tube Corp., 1200 E. Mermaid Lane, Philadelphia 18, Pa.—BCO

Electron-Radar Products, Inc., 1041 N. Pulaski Road, Chicago 51, Ill.—BBC, BBD, BBE, BCA, BCE, BCG, BCH

Electronic Workshop, The, 351 Bleecker St., New York 14, N. Y.—BCM

Electro Products Labs., 4501 N. Ravenswood Ave., Chicago 40, Ill.—BBX, BCA, BCI

Electro-Technic Prods., 4602 W. Montrose Ave., Chicago 41, Ill.—BBL

Electro-Tech Equipment Co., 308 Canal St., New York 13, N. Y.—BBF, BBG, BBH, BBI, BBY, BCA, BCD, BCE, BCH, BCI, BCO, BCR, BCS, BCW, BCX, BCY, BCZ

Electro Vision Laboratory, 30-06 Crescent St., Long Island City 2, N. Y.—BBA

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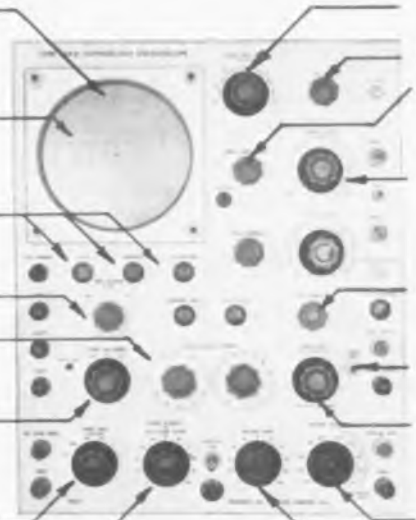

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More than 6 cm undistorted

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Modulates trace brightness, pips spaced 1 μsec, 0.1 μsec, 0.05 μsec, or 200 pips per television line

Regulation
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$1180 f.o.b. Portland, Oregon

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Langevin Mfg., 37 W. 65, New York 23, N. Y.—BBA
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Lavoie Laboratories, Morganville, N. J.—BBT, BBU, BBV, BCF, BCO
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Leonard Electric Products Co., 67 34 St., Brooklyn 32, N. Y.—BBA, BBK
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Liston-Becker Instrument Co., 20 Beckley Ave., Stamford, Conn.—BBA, BCA
Lloyd's Enterprises, Altadena, Calif.—BCW
Lyman Electronic Corp., 12 Cass St., Springfield, Mass.—BCY
Lysco Mfg. Co., 1401 Clinton St., Hoboken, N. J.—BCF, BCY
Magna Electronics Co., 9810 Anza Ave., Box 338, Inglewood, Calif.—BBA
Magnetic Amplifiers Inc., 632 Tinton Ave., New York 55, N. Y.—BBA
Marma Electronic Co., 703 Willow St., Chicago 14, Ill.—BBC, BBD
Maryland Electronic Mfg. Corp., 5009 Calvert Rd., College Park, Md.—BCO
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Master Appliances, Inc., 1600 Factory Ave., Marion, Ind.—BCA
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Measurements Corp., Box 180, Boonton, N. J.—BBD, BBM, BBN, BBO, BBT, BBU, BBY, BCA, BCD, BCF, BCN, BCQ, BCX
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Meters, Inc., 915 Westfield Blvd., Indianapolis 20, Ind.—BBK
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Microwave Assoc., Inc., 22 Cummington St., Boston 15, Mass.—BBR
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Miller Corp., Wm., 325 N. Halstead Ave., Pasadena 8, Calif.—BCI
Millivac Instrument Corp., 444 Second St., Schenectady 6, N. Y.—BCX

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Moulic Specialties Co., 1005-7 W. Washington St., Bloomington, Ill.—BBA, BBK
MP Concert Installations, Fairfield 10, Conn.—BB, BBI, BBK
Munston Mfg. & Service, Inc., Beech St., Islip, L. I., N. Y.—BBI
National Research Corp., 70 Memorial Dr., Cambridge, Mass.—BBK, BBL, BCA
National Technical Labs., 820 Mission St., S. Pasadena, Calif.—BCA
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Neutronic Assoc., 83-56 Victor Ave., Elmhurst, N. Y.—BBK, BCA
Norrman Labs., Ernst, Williams Bay, Wis.—BCE
Offner Electronics, 5320 N. Kedzie Ave., Chicago, Ill.—BBY, BCA
Ohmite Mfg. Co., 4835 W. Flournoy St., Chicago, Ill.—BBC, BBF
Owen Labs., 412 Woodward Blvd., Pasadena 10, Calif.—BBA, BBX
Pacific Mercury Television Mfg. Corp., 5955 Van Nuys, Calif.—BBA, BBK, BBM, BBN, BBO, BCE
Pacific Transducer Corp., 11921 S. West Pico Blvd., Los Angeles 64, Calif.—BCP, BCI
Pan-Electronics Co., 276 E. 150th St., New York, N. Y.—BBA, BCD
Panoramic Radio Products, Inc., 10 S. Second Ave., Mt. Vernon, N. Y.—BBR
Parsons Co., Ralph M., The, 689 S. Fair Oaks Ave., Pasadena 2, Calif.—BBS
PCA, Inc., 6368 DeLongpre Ave., Hollywood 28, Calif.—BBK, BBT
Peirce Wire Recorder Corp., 1328 Sherman St., Evanston, Ill.—BCW
Phaostron Co., 151 Pasadena Ave., S. Pasadena, Calif.—BCA, BCY
Photron Inst. Co., 6515 Detroit Ave., Cleveland 2, Ohio—BBA
Pickard & Burns, 240 Highland Ave., Needham 94, Mass.—BBA
Polarad Electronics Corp., 100 Metropolitan Ave., Brooklyn 11, N. Y.—BBB, BBD, BBP, BBR
Polytechnic Research & Development Co., 55 Johnson St., Brooklyn, N. Y.—BBA, BBB, BBD, BBN, BBO, BBR, BBS, BBT, BCE, BCN, BBW
Potter Instrument Co., 115 Cutter Mill Rd., Great Neck, N. Y.—BCE
Precise Development Corp., 999 Long Beach Rd., Oceanside, N. Y.—BBM, BBT, BBV, BCM, BCX, BCY
Precision Apparatus Co., 92-27 Horace Harding Blvd., Elmhurst, L. I., N. Y.—BBM, BBN, BBU, BBW, BCO, BCW, BCX, BCY
Precision Electronics, Inc., 641 Milwaukee Ave., Chicago 22, Ill.—BBU, BCX
Premier Electronic Labs., 382 Lafayette St., New York 3, N. Y.—BBU
Process & Instruments, 60 Greenpoint Ave., Brooklyn 22, N. Y.—BBA, BBK, BBL, BCA
Professional Electronics, 180 E. Calif. St., Pasadena, Calif.—BCA
Radex Corp., 2076 Elston Ave., Chicago 14, Ill.—BBH, BCM
Radiation Counter Labs., 51 W. Grove St., Skokie, Ill.—BBA, BBK, BCA
Radioactive Prods., Inc., 443 W. Congress St., Detroit 26, Mich.—BCO
Radio City Products Co., 152 W. 25th St., New York 1, N. Y.—BBI, BBM, BBN, BBO, BBU, BBV, BCO, BCW, BCX, BCY
Radio Corporation of America, RCA Tube Dept., Harrison, N. J.—BBK, BBL, BBO, BBU, BBW, BCN, BCO, BCX, BCY
Radio Frequency Labs., Boonton, N. J.—BBK, BCR
Radio Sonic Corp., 186 Union Ave., New Rochelle, N. Y.—BBA, BBB, BBK
Radio Supply & Eng'g Co., 85 Selden Ave., Detroit 1, Mich.—BCO
Radio Transceiver Labs., 116-23 Jamaica Ave., Richmond Hill 18, N. Y.—BCQ
Rahm Instruments, Inc., 12 W. Broadway, New York 7, N. Y.—BBA, BCM
Rawson Electrical Instrument Co., 117 Potter St., Cambridge 42, Mass.—BCA
Raypar Inc., 7810 W. Addison St., Chicago 13, Ill.—BBU
Reed Research, Inc., 1048 Potomac St., Washington 7, D. C.—BDC
Reiner Electronics Co., 152 W. 25th St., New York 1, N. Y.—BBI, BBK, BBU, BBV, BCX
Resdel Eng'g Corp., 2351 Riverside Dr., Los Angeles 39, Calif.—BBA, BBD, BBH, BBR, BBS, BBT, BBU, BBV, BCB, BCF, BCN, BCO, BCQ
Riverbank Labs., Dept. of Eng'g, Geneva, Ill.—BCU
Rixon Electronics, 3303 Ferndale St., Kensington, Md.—BBA, BBK, BCA
Rochester Electronics Co., Box 227, Penfield, N. Y.—BBF
Rollin Co., 2010 Lincoln Ave., Pasadena, Calif.—BBU
Rowe Industries, 1702 Wayne, Toledo, Ohio—BBA
Rutherford Electronics Co., 3707 S. Robertson Blvd., Culver City, Calif.—BBK, BBT, BBV, BBX, BCA
Rotishauser Corp., 490 S. Fair Oaks Ave., Pasadena, Calif.—BCA
Scott, Inc., Herman Hosmer, 385 Putnam Ave., Cambridge 39, Mass.—BBA, BBB, BBS, BCD, BCH, BCI, BCS
Sealtron Co., The, 9701 Reading Rd., Cincinnati 15, Ohio—BBA, BBF, BBK
Shallcross Mfg. Co., Pusex & Jackson Aves., Collingdale, Pa.—BBC, BBE, BBF, BBG, BBI, BCA
Shevers, Inc., Harold, 123 W. 64th St., New York 23, N. Y.—BBA, BBM, BBN, BBO, BBP, BBU, BBV, BBW, BCM, BCN, BCO, BCW, BCX, BCY
Sierra Electronic Corp., 1050 Brittan Ave., San Carlos, Calif.—BBA, BBB, BBD, BBK, BBT, BCA, BCO, BCT, BCX
Simpson Electric Co., 5200 W. Kinzie St., Chicago 44, Ill.—BBG, BBM, BBN, BBO, BBU, BBW, BCB, BCE, BCG, BCH, BCO, BCQ, BCS, BCT, BCW, BCX, BCY

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Sound Sales & Eng'g Co., 2005 La Branch, Houston 3 Tex —BBK, BCS
Southwestern Industrial Electronics Co., 2831 Post Oak Rd Houston 19, Tex.—BBH, BBK, BCA, BCK, BCM BCR, BCX
Special Instruments Lab., Inc., 1001 Highland Ave Knoxville, Tenn —BBA, BBI, BBK, BCA
Spectrum Engineers, 540 N 63rd St., Philadelphia 31, Pa —BBK
Spellman Television Co., 1025 Webster Ave., New York 67, N Y —BBK
Spencer-Kennedy Labs., Inc., 186 Massachusetts Ave Cambridge 39 Mass —BBA, BBD, BBT, BBW, BCA BCO
Sperry Gyroscope Co., Great Neck L. I., N. Y —BBD BBH, BBN, BBR, BBT, BBI, BBW, BBX, BCC BCE, BCG, BCN, BCT, BCI
Sprague Electric Co., Beaver St., N Adams, Mass —BBG
Square Root Mfg. Co., 391 Saw Mill River Rd., Yonkers 2, N Y —BBK, BCA
Standard Electronic Research Corp., 2 East End Ave., New York 21, N Y —BBA, BBK
Sterling Instruments Co., 13331 Linwood Ave., Detroit 6 Mich —BBK
Sticht Co., Herman H., 27 Park Place, New York 7 N Y —BBF, BBI, BCR, BCY
Stoddard Aircraft Radio Co., 6644 Santa Monica Blvd Hollywood 38, Calif.—BBD, BCQ
Stromberg-Carlson Co., 1225 Clifford Ave., Rochester, N Y —BBA
Sunrise Products, Box 173, Hawthorne, N J —BCV
Superior Instruments Co., 227 Fulton St., New York 7, N Y —BBO
Supreme, Inc., 1716 Carolton Dr., Greenwood Miss —BBM, BBN, BBO, BBP, BBI, BBW, BCM, BCO BCW, BCX, BCY
Sylvan Electronic Labs., Broadalbin, N Y —BCF
Sylvania Electric Prods. Co., 1740 Broadway, New York 19, N Y —BBL, BBM, BBN, BBI, BBW, BCO BCW, BCY
Syntronic Instruments, Inc., 100 Industrial Rd., Addison Ill —BBT, BBW, BBX, BCO
Taffet Radio & TV Co., 2530 Belmont Ave., New York 58, N Y —BBA, BCA
Tech Labs., Inc., Bergen & Edsall Blvd., Palisades Park, N J —BBC, BBE, BBF, BCA
Technicraft Labs., Inc., Thomaston Waterbury Rd Thomaston, Conn —BBD, BBK, BCA, BCI
Techno Instrument Co., 6666 Lexington Ave., Los Angeles 38, Calif —BCH
Technology Instrument Corp., 531 Main St., Acton, Mass —BBA, BBF, BBG, BBH, BBI, BBI, BCA
Tektronix, Inc., P. O. Box 831, Portland 7, Ore —BBA, BBT, BBV, BBX, BCO
TelAutograph Corp., 16 W 61st St., New York 23, N Y —BBA
Telechrome, Inc., 88 Merrick Rd., Amityville, L. I., N Y —BBA, BBB, BBK, BBO, BBP, BBQ, BBS, BBI, BBX, BCO
Telectro Industries Corp., 35-16 37th St., Long Island City 1, N Y —BBA, BBG, BBH, BBI, BBU, BCA BCY
Telegu'a Radio Co., 2559 W 21 St., Chicago 8, Ill —BBP
Teletronic Labs., Inc., 1835 W Rosecrans Ave., Gardena Calif —BBK, BCA, BCO
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Television Equip. Corp., 238 William St., New York 38, N Y —BBT, BBV, BCM, BCO
Television Projects, 3660 Coral Way, Miami 45, Fla —BBU, BBW
Tel-Instrument Co., 50 Paterson Ave., E. Rutherford, N J —BBA, BBD, BBO, BBW
Testing Instruments, Inc., 120 W 2nd St., Dayton 2 Ohio—BCA
Tetrad Co., 4054 Ocean Park, Venice, Calif —BCZ
Torocoil, 1374 Mobile Ct., St. Louis, Mo —BBF
Trac-Tape Recording Apparatus Co., Box 221, Caldwell N J —BCA
Transitron, Inc., 154 Spring St., New York 12, N Y —BBD, BBK, BBS, BBT, BBV
Transmitter Equip. Mfg. Co., 345 Hudson St., New York 14, N Y —BBA, BBK
Trans-Sonics, Inc., Bedford Airport, Bedford, Mass —BCA
Transvision, Inc., New Rochelle, N Y —BBW, BCQ
Tri-Dex Co., Box 1207, Lindsay, Calif.—BBA, BCM
Triplett Electrical Instrument Co., Harmon Rd., Bluffton Ohio—BBM, BBN, BBO, BBT, BBW, BCO, BCW BCX, BCY
Triumph Mfg. Co., 913 W. Van Buren St., Chicago 7 Ill—BBV, BCM, BCO, BCY
Trojan Electronics, 3706 N Halsted St., Chicago 13 Ill—BCW
Univox Corp., 83 Murray, New York 7, N Y —BBA
Utility Electronics Corp., 231 Grant Ave., E. Newark N. J.—BBA, BBM, BBN, BBU, BCM, BCN, BCY
Vacuum-Electronic Eng'g Co., 756 Third Ave., Brooklyn 32, N Y —BBL
Vacuum Tube Products, 506 S. Cleveland St., Oceanside Calif —BBL, BCL
Varo Mfg., 1801 Walnut, Garland, Tex —BBA, BCM
Vectron Mfg., 235 High, Waltham, Mass —BBX
Wadsworth Mfg. Assoc., 509 Balsam St., Liverpool, N Y —BBK
Walkirt Co., 145 W Hazel St., Inglewood 3, Calif —BBA, BBT, BBU, BBV, BCE, BCL, BCU
Wang Labs., 296 Columbus, Boston, Mass —BCE
Waterman Products Co., 2445 Emerald St., Philadelphia 25, Pa —BCO
Waveforms, Inc., 333 Sixth Ave., New York 14, N. Y. —BBA, BBK, BBM, BBN, BCM, BCX
Waveline, Inc., P. O., Box 470, Caldwell, N. J —BBD, BBR
Weinschel Eng'g Co., 919 Jesup Blair Dr., Silver Spring, Md —BBD, BBM, BCM
Welch Electric Co., 1221 Wade St., Cincinnati 14, Ohio—BCA, BCR
Western Sound & Electric Labs., Inc., 805 S. 5th St. Milwaukee 4, Wis —BBA, BBC, BBG, BBH, BBI, BBU, BBV, BCM, BCX
Weston Labs., 410 Glen Rd., Weston 93, Mass —BCM BCX
Wheeler Labs., Inc., 122 Cutter Mill Rd., Great Neck N. Y. —BBK, BBR

28—Indicating Devices

Aero Instrument Co., 11423 Vanowen St., N Hollywood, Calif —CCD
American Hydromath Corp., 145 W 57th St., New York 19, N Y —CCH
Andrew Corp., 363 E 75, Chicago, Ill —CCA
Assembly Products, Chagrin Falls, Ohio —CCF
Associated Projects Co., 157 Marconi Blvd., Columbus, Ohio —CCH
Associated Research, Inc., 3758 W Belmont Ave Chicago 18, Ill —CCG
Ballantine Laboratories, Inc., Boonton, N J —CCF
Barber-Colman Co., 1300 Rock St., Rockford, Ill CCC, CCF, CCI
Barker & Williamson Co., 237 Fairfield Ave., Upper Darby, Pa —CCD
Barnes Development Co., 213 W Baltimore Pike Lansdowne, Pa —CCI
Bassett, Inc., Rex, 1414 N E 17 Court, Ft. Lauderdale, Fla —CCD
Beede Electrical Instrument Co., Penacook, N H —CCB CCC, CCF, CCG
Berkeley Scientific Corp., Div. Beckman Instruments, Inc., 2200 Wright Ave., Richmond, Calif —CCD
Berndt-Bach, Inc., Auricon Div., 7325 Beverly Blvd Los Angeles 36, Calif —CCB
Beta Electric Corp., [illegible] E 101 St., New York 29, N Y —CCF
Biddle Co., James G., 1316 Arch St., Philadelphia 7, Pa —CCB, CCD
Bird Electronic Corp., 1800 E 38 St., Cleveland 14 Ohio —CCE, CCI
Brush Development Co., 3405 Perkins Ave., Cleveland 14, Ohio —CCB
Burlington Instrument Co., 203 N 4 St., Burlington, Iowa —CCC, CCF, CCI
Burnett Radio Lab., Wm. W. L., 4814 Idaho St., San Diego 16, Calif —CCD
Burton-Rogers Co., 292 Main St., Cambridge 42, Mass —CCC, CCF
Chicago Industrial Instrument Co., 536 W Elm St Chicago 10, Ill —CCC, CCF
Cinema Engineering Co., 1510 W Verdugo Ave., Burbank, Calif —CCJ
Cole Instrument Co., 1320 S Grand Ave., Los Angeles 15, Calif —CCA, CCG, CCJ
Conn Ltd., C. G., Electronics Div., Jackson Blvd., Elkhart, Ind —CCD
Continental Electronics Mfg. Co., 4212 S Buckner Blvd., Dallas 10, Tex —CCA
Cubic Corp., 2841 Canon, San Diego, Calif —CCE
Daven Co., 193 Central Ave., Newark 4, N J —CCD CCF, CCH, CCJ
Delta Electrical Instrument Co., 2700 S Hill St., Los Angeles 7, Calif —CCC
Diamond Mfg., 7 North Ave., Wakefield, Mass —CCD
Electric Design & Mfg. Co., Burlington, Iowa —CCC, CCF
Electrix Corp., 150 Mobile, Pawtucket, R I —CCD
Electrodyne Co., 32 Oliver, Boston 10, Mass —CCI
Electronic Development Laboratory, 13-07 23 Ave., Long Island City 5, N Y —CCJ
Electronic Signal Co., 541 Willis Ave., Williston Park, N Y —CCI
Electron-Radar Products, Inc., 1041 N Pulaski Rd Chicago 51, Ill —CCD
Electro-Tech Equipment Co., 308 Canal St., New York 13, N Y —CCA, CCB, CCC, CCD, CCE, CCF, CCG, CCH, CCI, CCJ
Equipment & Service Co., 6815 Oriole Dr., Dallas 7, Tex —CCC, CCD, CCE, CCF, CCJ
Federal Mfg. & Engineering Corp., 211 Steuben St Brooklyn 5, N Y —CCD
Feiler Engineering Co., 8026 Monticello Ave., Skokie Ill —CCH
Field Electrical Instrument Co., 8 N Manheim Blvd., New Paltz, N Y —CCI
Fielden Instrument Corp., 2920 N Fourth St., Philadelphia 33, Pa —CCI
Fluke Engineering Co., John, Box 755, Springdale Conn —CCC, CCE, CCF
Gates Radio Co., 123 Hampshire, Quincy, Ill —CCJ
Gaydon Co., 561 Hillgrove, La Grange, Ill —CCG
G & M Equipment Co., 7315 Varna Ave., N. Hollywood, Calif —CCD
Hastings Instrument Co., Super H'way & Pine Ave., Hampton, Va —CCI
Heath Co., Benton Harbor, Mich —CCF
Hewlett-Packard Co., 395 Page Mill Rd., Palo Alto, Calif —CCD, CCF
Illinois Testing Labs., Inc., 420 N LaSalle St., Chicago 10, Ill —CCG, CCI
Industrial Devices, Inc., 22 State Rd., Edgewater 21, N J —CCC, CCF
Instrument Laboratories, 315 W Walton Pl., Chicago 10, Ill —CCC, CCF, CCG
International Instruments Inc., [illegible] St., New Haven 11, Conn —CCI
Ionic Equipment Co., 1705 N Kenmore, Los Angeles 27, Calif —CCH
J-B-T Instruments, Inc., 441 Chapel St., New Haven 8, Conn.—CCD, CCI
Jerrold Electronics Corp., 26 & Dickinson Sts., Philadelphia 46, Pa —CCD
Jones Electronics Co., M. C., 96 N. Main St., Bristol, Conn —CCE
Link Radio Corp., 125 W 17 St., New York 11, N. Y. —CCD, CCE
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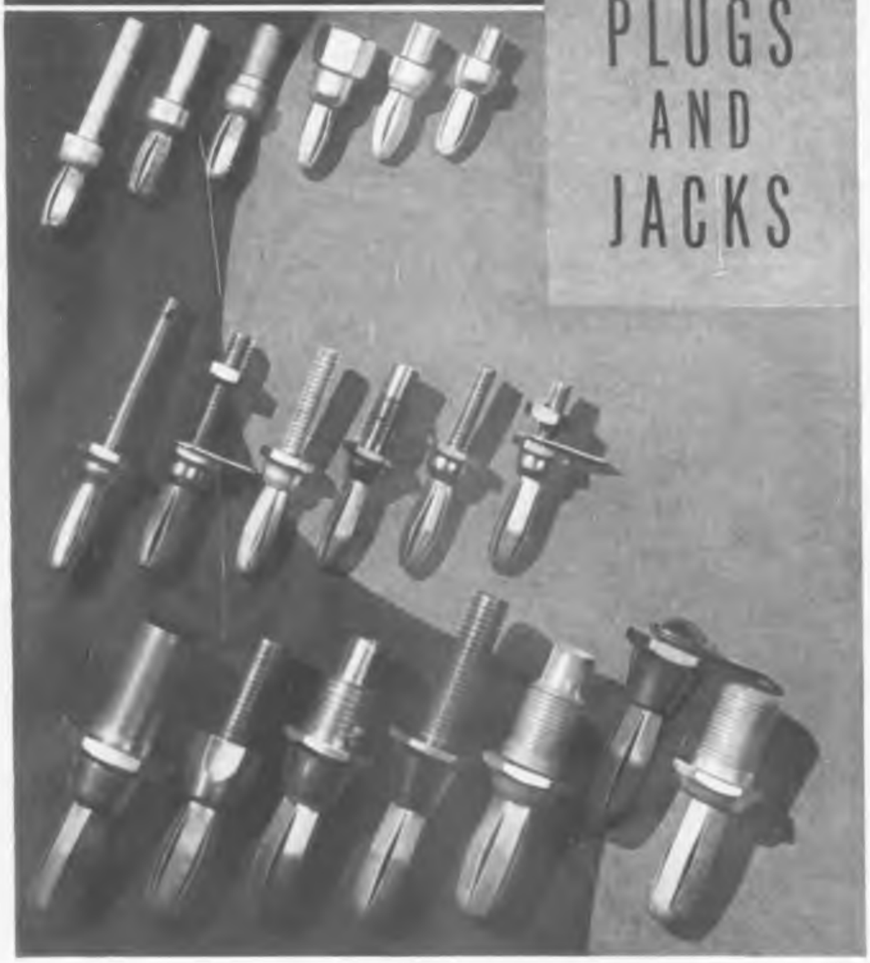

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Meters, Inc., 915 Westfield Blvd., Indianapolis 20, Ind.—CCH, CCJ
Metropolitan Electronics, 106 5 Ave., New York 11, N. Y.—CCB
Midwestern Geophysical Lab., 3401 S. Harvard Ave., Tulsa, Okla.—CCB
Modulation Products Co., 56 Lispenard St., New York 13, N. Y.—CCC, CCF, CCG, CCH, CCJ
National Research Corp., 70 Memorial Dr., Cambridge 42, Mass.—CCH, CCI
Phaostron Co., 151 Pasadena Ave., S. Pasadena, Calif.—CCA, CCC, CCE, CCF
Precision Apparatus Co., 92-27 Horace Harding Blvd., Elmhurst, L. I., N. Y.—CCC, CCF
Pyramid Instrument Corp., 630 Merrick Rd., Lynbrook, N. Y.—CCC, CCF
Pyrometer Instrument Co., Bergenfield, N. J.—CCI
Radio Frequency Labs., Boonton, N. J.—CCH, CCE
Rawson Electrical Instrument Co., 117 Potter St., Cambridge 42, Mass.—CCF, CCI
Reeder & Co., Charles M., 171 Victor Ave., Detroit 3, Mich.—CCI
Shallcross Mfg. Co., Pusey & Jackson Aves., Collingdale, Pa.—CCB
Sierra Electronic Corp., 1050 Brittan Ave., San Carlos, Calif.—CCE
Simpson Electric Co., 5200 W. Kinzie St., Chicago 44, Ill.—CCB, CCC, CCD, CCE, CCF, CCG, CCH, CCI, CCJ
Sound Sales & Engineering Co., 2005 La Branch, Houston 3, Tex.—CCJ
Spellman Television Co., 3029 Webster Ave., New York 67, N. Y.—CCF
Sperry Gryoscope Co., Div. Sperry Corp., Great Neck, L. I., N. Y.—CCD, CCE
Sterling Mfg. Co., 7201 Wentworth Ave., Cleveland 2, Ohio—CCC, CCF, CCH
Sunrise Products Co., Box 173, Hawthorne, N. J.—CCH
Supreme, Inc., 1716 Carolton Dr., Greenwood, Miss.—CCC, CCF, CCG
Taco West Corp., 525 N. Noble St., Chicago 22, Ill.—CCB, CCC, CCF
Telectro Industries Corp., 35 16 37 St., Long Island City 1, N. Y.—CCH
Trans-Sonics, Inc., Bedford Airport, Bedford, Mass.—CCI
Triplett Electrical Instrument Co., Harmon Rd., Bluffton, Ohio—CCC, CCF, CCI, CCJ
Walkirt Co., The, 145 W. Hazel St., Inglewood 3, Calif.—CCD
Wang Laboratories, 296 Columbus Ave., Boston 16, Mass.—CCD
Waveforms, Inc., 333 6 Ave., New York, N. Y.—CCF
Welch Mfg. Co., W. M., 1515 Sedgwick St., Chicago 10, Ill.—CCC, CCD, CCF, CCI
Weston Electrical Instr. Corp., 614 Frelinghuysen Ave., Newark 5, N. J.—CCC, CCD, CCE, CCF, CCI, CCJ
Weymouth Instrument Co., 1440 Commercial St., E. Weymouth 89, Mass.—CCD

29—Major Replacement Parts

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electroytic .... DDD
mica .... DDE
oil .... DDF
paper .... DDG
pressurized .... DDH
tantalum .... DDI
vacuum .... DDJ

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Delay lines .... DEF
Filters, RF interference .... DDM
Inductances, filter .... DDN
Inductances, tuning .... DDO
Rectifiers, metal .... DDP
Relays, antenna .... DDQ
Relays, audio control .... DDR
Relays, power .... DDS
Relays, time delay .... DEI
Relays, video control .... DDT
Resistors, power type .... DDU
Resistors, variable .... DDV
Switches, lever .... DDW
Switches, mercury .... DDX
Switches, power .... DDY
Switches, rotary .... DDZ
Switches, time delay .... DEA
Transformers, audio .... DEB
Transformers, Flyback .... DEG
Transformers, power .... DEC
Transformers, pulse .... DED
Switches, vacuum .... DEH

Accurate Engineering Co., 2005 Blue Island Ave., Chicago 8, Ill.—DEC
Acme Electric Corp., Water St., Cuba, N. Y.—DDN, DEB, DEC, DED
Acme Electronics, Inc., 300 N. Lake Ave., Pasadena 4, Calif.—DDM
Acorn Electronics Corp., Box 348, Gibson City, Ill.—DEB, DEC, DED
Aero Products Co., 215 Arch St., Philadelphia 6, Pa.—DEB, DEC

ro Transformer & Mfg. Corp., 26 02 4th St., Long Island City 2, N. Y.—DDN, DER, DEC, DED
Adams & Westlake Co., 1025 N. Michigan, Elkhart, Ind —DDS, DDX, DEA, DEI
Advance Electric & Relay Co., 2435 N. Naomi St., Burbank, Calif.—DDQ, DDR, DDS, DDT
Advance Electronics Co., Box 394, Passaic, N. J.—DEF
Advance Insulated Wire & Cable Co., 72 Woolsey St., Irvington 11, N. J.—DDA
Advance Transformer Co., 1122 W. Catalpa Ave., Chicago 40, Ill.—DEC
erocoil, Inc., 507 26 St., Union City, N. J.—DDM, DDO
erovox Corp., 740 Belleville Ave., New Bedford, Mass.—DDC, DDD, DDE, DDF, DDG, DDM
ircraft Transformer, Long Branch, N. J.—DEC
irpeax Products Co., Middle River, Baltimore 20, Md.—DDM, DDN, DDO, DEB, DEC, DED
llen-Bradley Co., 138 W. Greenfield Ave., Milwaukee 4, Wisc.—DDR, DDS, DDV
llied Allegri Machine Co., 141 River Rd., Nutley 10, N. J.—DDM, DDO
llied Control Co., 2 East End Ave., New York 21, N. Y.—DDQ, DDR, DDS
ll Star Products, Box 187, Defiance, Ohio—DDB
lpha Electronics, Inc., 53 Bergen Turnpike, Little Ferry, N. J.—DDL
Alpha Electronics, Inc., 53 Bergen Turnpike, Little Ferry, N. J.—DDL
ltec Lansing Corp., 9356 Santa Monica Blvd., Beverly Hills, Calif.—DER, DED
Amalgamated E'tronics, Clinton Corners, N. Y.—DDV
American Condenser Co., 4410 N. Ravenswood Ave., Chicago 40, Ill.—DDD, DDG
American Electric Cable Co., 181 Appleton St., Holyoke, Mass.—DDA
American Gas Accumulator Co., 1029 Newark Ave., Elizabeth 2, N. J.—DDS
American Phenolic Corp., 1830 S. 54 Ave., Chicago 50, Ill.—DDA
American Radio Hardware Co., 152 Mac Questen Pkwy. S., Mt. Vernon, N. Y.—DDW
American Radionic Co., 33 Flatbush Ave., Brooklyn 17, N. Y.—DDF, DDG
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American Transformer Co., 178 Emmet St., Newark 5, N. J.—DEC
Amperex Electronic Corp., 230 Duffy Ave., Hicksville, L. I., N. Y.—DDJ
Amperite, 561 Broadway, New York, N. Y.—DEI
Andersen Laboratories, Inc., 39 Talcott Rd., W. Hartford 10, Conn.—DEF
Andrew Corp., 363 E. 75 St., Chicago 20, Ill.—DDQ
Anthony Mfg. Co., 2322 W. Slauson Ave., Los Angeles 43, Calif.—DEB, DEC
Applied Science Corp. of Princeton, P. O. Box 44, Princeton, N. J.—DDZ
Assembly Products, Inc., Chagrin Falls, Ohio—DDS
Astron Corp., 255 Grant Ave., E. Newark, N. J.—DDD, DDF, DDG
Atlas Resistor Co., 423 Broome St., New York 13, N. Y.—DDU, DDV
Audio Development Co., 2833 13 Ave. S., Minneapolis 7, Minn.—DDN, DEB, DEC, DED
Audio & Video Products Corp., 730 5 Ave., New York 3, N. Y.—DEB
Autocall Co., Shelby, Ohio—DDS
Aurex Corp., 1117 N. Franklin St., Chicago 10, Ill.—DER
Automatic Electric Mfg. Co., 10 State St., Mankato, Minn.—DDQ, DDR, DDS, DDT, DEA
Automatic Electric Co., 1033 W. Van Buren St., Chicago 7, Ill.—DDG, DDQ, DDR, DDS, DDT, DDW, DDZ
Automatic Mfg. Corp., 65 Gouverneur St., Newark 4, N. J.—DDU, DDO
Bardwell & McAlister, 2950 N. Ontario St., Burbank, Calif.—DDM, DDN, DDO
Beam Instruments Corp., 350 5 Ave., New York 1, N. Y.—DDA
Berkshire Laboratories, 588 Beaver Pond Rd., Lincoln, Mass.—DED
Birdsall Mfg. Co., 750 San Antonio Rd., Palo Alto, Calif.—DEC
Bogen Co., David, 29 9th Ave., New York 14, N. Y.—DEB, DEC
Bond Electronics, 60 Springfield Ave., Springfield, N. J.—DDT
Brand & Co., William, North & Valley St., Willimantic, Conn.—DDA
Broadway Coil Co., 5638 N. Broadway, Chicago 40, Ill.—DDO
Bunnell & Co., J. H., 81 Prospect St., Brooklyn 1, N. Y.—DDO, DDR
Burnell & Co., 45 Warburton Ave., Yonkers 2, N. Y.—DEF
Burton Electronic Mfg. Co., 2353 Cotner Ave., Los Angeles 35, Calif.—DDV
Calif. Electronic Services, 21332 Ventura Blvd., Woodland Hills, Calif.—DDM
Camfield Mfg. Co., 7 St., Grand Haven, Mich.—DDM, DDZ
Carbonneau Industries, Inc., 21 Ionia N. W., Grand Rapids 2, Mich.—DDM
Carborundum Co., Globar Div., Niagara Falls, N. Y.—DDU
Cardwell Mfg. Co., Allen D., Plainville, Conn.—DDB
Carter Parts Co., 213 Institute Pl., Chicago 10, Ill.—DDU, DDV, DDW, DDZ
Centralab, Div., Globe-Union, Inc., 900 E. Keefe Ave., Milwaukee 1, Wisc.—DDC, DDV, DDW, DDY, DDZ
Central Transformer Co., 910 W. Jackson Blvd., Chicago 7, Ill.—DDN, DDO, DEB, DEC, DED
Ceramic Heater Cathode Resistor Co., 20 First St., Keyport, N. J.—DDU
C. G. S. Laboratories, Inc., 391 Ludlow St., Stamford, Conn.—DDN, DDO
Chatham Electronics Corp., 475 Washington St., Newark 2, N. J.—DDX
Chase Brass & Copper Co., 236 Grand St., Waterbury 20, Conn.—DDA
Chemo-Vac Electronic Corp., 760 Reed St., Santa Clara, Calif.—DDJ
Chester Cable Corp., Chester, N. Y.—DDA
Chicago Condenser Corp., 3255 W. Armitage Ave., Chicago 47, Ill.—DDF, DDG
Chicago Telephone Supply Corp., 1142 W. Beardsley Ave., Elkhart, Ind.—DDV

Chicago Transformer Div., Essex Wire Corp., 3501 Addison St., Chicago 18, Ill—DEB, DEC, DED
Church Co., George H., 5109 Halifax Ave., Minneapolis 10, Minn—DDF, DDG, DDM
Cima Corp., 119 Braintree St., Allston 34, Mass—DDU
Cinema Engineering Co., 1510 W. Verdugo Ave., Burbank Calif—DDZ
Clare & Co., C. P., 4719 Sunnyside Ave., Chicago 30, Ill—DDQ, DDR, DDS, DDT, DDW
Clark Electronic Laboratories, Box 165, Palm Springs, Calif—DDP
Clarostat Mfg. Co., Dover, N. H.—DDV, DDI
Cleveland Container Co., 6201 Barberton Ave., Cleveland 2, Ohio—DDQ, DDR
Coil Winders, Inc., New York Ave., Westbury, L. I., N. Y.—DDI, DDM, DDN, DDO
Columbia Technical Corp., 5 E. 57 St., New York 22, N. Y.—DEA, DEF
Columbia Wire & Supply Co., 2850 Irving Pk. Rd., Chicago 18, Ill—DDX
Columbus Process Co., State & Maple Sts., Columbus Ind—DEA
Communication Accessories Co., 110 St. & Hillcrest Rd., Hickman Mills, Mo.—DDN, DEB, DED
Communication Products Co., Marlboro, N. J.—DDZ
Conant Laboratories, 6500 O St., Lincoln 5, Nebr.—DDP
Condenser Products Co., 7517 N. Clark St., Chicago 26, Ill—DDF
Conn. Telephone & Electric, 70 Brittannia St., Meriden, Conn.—DDW
Cook Electric Co., 2700 Southport Ave., Chicago 14, Ill—DDR, DDS
Cornell-Dubilier Electric Corp., 333 Hamilton Blvd., S. Plainfield, N. J.—DDC, DDD, DDE, DDF, DDG, DDH, DDI, DDM, DDW
Cosmic Radio Corp., 853 Whittier St., New York 59, N. Y.—DDD, DDG
Cramer Co., R. W., Centerbrook, Conn.—DEA
Crescent Co., Box 260, Pawtucket, R. I.—DDA
Crest Laboratories, Inc., Whitehall Bldg., Far Rockaway 91, N. Y.—DEB, DEC, DED
Crest Transformer Corp., 1834 W. North Ave., Chicago 22, Ill—DDN, DEB, DEC
Crittenden Transformer Works, 1220 Nadeau St., Los Angeles 1, Calif—DEB, DEC, DED
Cutler Hammer, Inc., 411 N. 12 St., Milwaukee 1, Wisc—DDS
Dale Products, Inc., Box 1, Columbus, Nebr.—DDI
Daven Co., 193 Central Ave., Newark 4, N. J.—DDV, DDZ
De Coursey Eng'g. Lab., Box 235, W. Los Angeles 25, Calif—DDN
Delco Radio, Box 777, Kokomo, Ind—DEB, DEC
Dietz Design & Mfg. Co., Grandview, Mo.—DDN, DDO, DEB, DEC
Dinion Coil Co., Drawer D, Caledonia, N. Y.—DEB, DEC, DED
Dittmore & Freimuth Co., 2517 E. Norwich St., Cudahy, Wisc—DDB, DEB, DEC
Dolinko & Wilkens, Inc., 89 Adams St., Hoboken, N. J.—DDJ
DIT-MCO, Inc., 505 W. 9 St., Kansas City 6, Mo.—DEE
Drake Co., R. L., 11 Longworth St., Dayton 2, Ohio—DDM
Dumont Electric Corp., 308 Dyckman, New York 34, N. Y.—DDD, DDF, DDG
Dunkle Coil Co., 2508 W. 8 St., Los Angeles 5, Calif—DEC
Durakool, Inc., 1010 N. Main, Elkhart, Ind—DDS
DX Radio Products Co., 2300 W. Armitage Ave., Chicago 47, Ill—DDI, DDN, DDO
Dynamic Resistor Corp., 42-27 Francis Lewis Blvd., Bayside, L. I., N. Y.—DDU
Eagle Electric Mfg. Co., 23-10 Bridge Plaza S., Long Island City 1, N. Y.—DDA, DDU, DDW, DDY, DDZ
Ebert Electronics Co., 185-09 Jamaica Ave., Hollis 7, N. Y.—DDS, DDX
Edison, Inc., Thomas A., Instrument Div., 92 Lakeside Ave., W. Orange, N. J.—DEA
Electricoil Transformer Co., Westerly Rd., Ossining, N. Y.—DDP, DEC
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago 39, Ill—DEB, DEC
Electro-Cap, Inc., 1269 Riverside Dr., Los Angeles 31, Calif—DDC
Electro Development Corp., 6014 Washington Blvd., Culver City, Calif—DDZ
Electro Eng'g. Works, 6021 College Ave., Oakland 18, Calif—DEC
Electro Motive Mfg., Willimantic, Conn.—DDC, DDE
Electronic Apparatus Corp., 116 E. Jackson Blvd., Elkhart, Ind—DDS, DDX
Electronic Development Laboratory, 45-07 23 Ave., Long Island City 3, N. Y.—DEB, DEC
Electronic Devices, Inc., 429 12 St., Brooklyn 15, N. Y.—DDP
Electronic Indicator Corp., 259 Green St., Brooklyn, N. Y.—DDU
Electronic Rectifiers, Inc., 2102 Spann Ave., Indianapolis 3, Ind—DDP
Electronic Transformer Co., 207 W. 25 St., New York 1, N. Y.—DDN, DDO, DEB, DEC, DED
Electro Switch Corp., 167 King Ave., Weymouth 88, Mass—DDZ
Electro-Tech Equipment Co., 308 Canal St., New York 13, N. Y.—DDO, DDP, DDQ, DDR, DDS, DDT, DDU, DDV, DDW, DDX, DDY, DDZ, DEA, DEC
El-Rad Mfg. Co., 4087 N. Broadway, Chicago 13, Ill—DDN, DDO, DDQ, DDR, DDS
Engineered Instruments, Inc., 845 Soto St., Hayward, Calif—DDQ
Engineering Research Assoc., Inc., 1902 W. Minnehaha Ave., St. Paul W4, Minn—DEB
Equipment & Service Co., 6815 Oriole Dr., Dallas 7, Tex—DDD, DDP, DDQ, DDR, DDT, DDU, DDV, DDZ, DER, DEC, DED
Erie Resistor Co., 644 W. 12 St., Erie 6, Pa—DDC, DDE
Essex Electronics, Springfield Ave., Berkeley Heights, N. J.—DDO
Eureka Television & Tube Corp., 69 Fifth Ave., Hawthorne, N. J.—DEA
Fansteel Metallurgical Corp., 2200 Sheridan Rd., N. Chicago, Ill—DDI, DDP
Fast & Co., John E., 3129 N. Crawford Ave., Chicago 41, Ill—DDF, DDG
Ferranti Electric, Inc., 30 Rockefeller Plaza, New York 20, N. Y.—DDN, DEB, DEC, DED

Filtron Co., 131-05 Fowler Ave., Flushing 55, N. Y.—DDG, DDM, DDN
Ford Eng'g., 129 E. "A" St., Upland, Calif—DDV
Forest Electric Co., 7216 Circle Ave., Forest Park, Ill—DDO, DEB
Foster Transformer Co., 3820 Colerain Ave., Cincinnati 23, Ohio—DEB, DEC, DED
Franklin Television Labs., Inc., 18 Johnson Ave., Brooklyn 6, N. Y.—DEG
Freed Transformer Co., 1718 Weirfield St., Brooklyn 27, N. Y.—DDN, DEB, DEC, DED
Galvanic Products Corp., 110 E. Hawthorne Ave., Valley Stream 10, N. Y.—DDP
Gamewell Co., 1238 Chestnut St., Newton Upper Falls 64, Mass—DDV, DDW, DDZ
Gardner Electric Mfg. Co., 4227 Hollis St., Emeryville 8, Calif—DEC
Gates Radio Co., 123 Hampshire St., Quincy 1, Ill—DDO, DDY
Gee-Lar Mfg. Co., 1330 10 Ave., Rockford, Ill—DDW, DDX, DDY, DDZ
General Cement Mfg. Co., 919 Taylor Ave., Rockford Ill—DDW, DDY, DDZ
General Control Co., 1200 Soldiers Field Rd., Boston 34 Mass—DDW, DDZ, DEA
General Instrument Corp., 829 Newark Ave., Elizabeth 3, N. J.—DDB, DDH, DDJ, DDI, DDM, DDN, DDO
General Insulated Wire Works, Inc., 69 Gordon Ave., Providence 5, R. I.—DDA
General Transformer Co., 18240 Harwood Ave., Homewood, Ill—DEB, DEC
Gilandun Electronics, Rt. 1, Box 489, Cupertino, Calif.—DDH

Broadcast Stations in U.S.

	AM	FM	TV
Stations on Air	2347	625	109 VHF
Under Construction (CPs)	132	68	38 UHF & 11 VHF
Applications Pending	265	11	294 UHF & 442 VHF

Girard-Hopkins, 1000 40th Ave., Oakland 1, Calif—DDG
Goslin Electric & Mfg. Co., 2921 W. Olive Ave., Burbank Calif—DEB, DEC
Gramer Transformer Corp., 2734 N. Pulaski Rd., Chicago 39, Ill—DDN, DEB, DEC, DED
Grayhill, 4524 W. Madison St., Chicago, Ill—DDZ
Grigsby-Allison Co., 407 N. Salem Ave., Arlington Heights, Ill—DDW, DDZ
Guardian Electric Mfg. Co., 1621 W. Walnut St., Chicago 7, Ill—DDK, DDQ, DDR, DDS
Gudeman Co., 340 W. Huron St., Chicago 10, Ill—DDD, DDF, DDG, DDI
Gulton Mfg. Corp., 212 Durham Ave., Metuchen, N. J.—DEB
Guthman & Co., Edwin I., 15 S. Throop St., Chicago 7, Ill—DEF
G-V Controls, 28 Hollywood Pl., E. Orange, N. J.—DEA
Hadley, Robert M., 5112 S. Hoover St., Los Angeles, Calif—DEC
Halldorson Transformer Co., 4500 Ravenswood Ave., Chicago 40, Ill—DEB, DEC
Hallett Mfg. Co., 1601 W. Florence Ave., Inglewood Calif—DDA, DDM
Hamilton-Hall Mfg. Co., 222 N. Water St., Milwaukee 2, Wis—DDI
Hammarlund Mfg. Co., 460 W. 34 St., New York 1, N. Y.—DDB
Hansell, Inc., U., 50 Liberty St., Westerly, R. I.—DDC
Hardwick, Hindle, Inc., 40 Hermon St., Newark, N. J.—DDI, DDV
Hart Mfg. Co., 110 Bartholomew Ave., Hartford 1, Conn—DDS, DDW, DDZ
Haydon Mfg. Co., 245 E. Elm, Torrington, Conn—DEA
Heinemann Electric Co., Penna. Ave. & Plum St., Trenton 8, N. J.—DDK, DEA, DEI
Helipot Corp., 916 Meridian Ave., S. Pasadena, Calif—DDV
Herlec Corp., 422 N. 5 St., Milwaukee 3, Wis—DDC
Hetherington, Inc., 1200 Elmwood Ave., Sharon Hill Pa—DDW
Highland Engineering Co., Main & Urban, Westbury L. I., N. Y.—DDN, DEB, DEC, DED
Hindle Transformer Co., Woods Church Rd., Flemington N. J.—DEB, DEC, DED
Hi-Q Division, Aerovox Corp., Olean, N. Y.—DDC, DDI
Hopkins Eng'g. Co., 2082 Lincoln Ave., Altadena, Calif—DDM
Hufco Industries, Burbank, Calif—DDQ, DDS
Hycor Co., 11423 Vanowen St., N. Hollywood, Calif—DDO
Illinois Condenser Co., 1616 N. Throop St., Chicago 22 Ill—DDD
Imperial Radar & Wire Corp., 4342 Bronx Blvd., Bronx 66, N. Y.—DDA
Industrial Condenser Corp., 3243 N. Calif. Ave., Chicago 18, Ill—DDA
INET, Inc., 8655 S. Main St., Los Angeles 3, Calif—DDP, DEC
Instrument Resistors Co., 1036 Commerce Ave., Union N. J.—DDI
International Rectifier Corp., 1521 E. Grand Ave., El Segundo, Calif—DDP
International Resistance Co., 401 N. Broad St., Philadelphia 8, Pa—DDU, DDV
I-T-E Circuit Breaker Co., Resistor Div., 19 & Hamilton Sts., Philadelphia 30, Pa—DDI, DDU, DDV
Jacobs Instrument Co., 4718 Bethesda Ave., Bethesda 14, Md.—DED
J-B-T Instruments, Inc., 441 Chapel St., New Haven 8, Conn—DDW, DDZ
Jeffers Electronics Div., Speer Carbon Co., DuBois, Pa—DDC
Jefferies Transformers Co., 1710 E. 57 St., Los Angeles, Calif—DEC
Jefferson Electric Co., 900 25 Ave., Belwood, Ill.—DEB
Jennings Radio Mfg. Co., 970 McLaughlin Ave., San Jose 8, Calif—DDJ, DEB
JFD Electronics, 6127 16th Ave., Brooklyn 4, N. Y.—DDR
Johnson Co., E. F., Waseca, Minn—DDB, DDH, DDN, DDO, DDQ.

Kellogg Switchboard & Supply Co., 6650 S. Cicero Ave., Chicago 38, Ill—DDA, DDR, DDW
Kenyon Transformer Co., 840 Barry St., New York 59, N. Y.—DEC
Keystone Products Co., 904 23 St., Union City, N. J.—DEC
K-F Development Co., 867 Woodside Way, San Mateo, Calif—DDV
Kolton Electric Mfg. Co., 123 N. J. Railroad Ave., Newark 5, N. J.—DDK, DDY
Kulka Electric Mfg. Co., 633 S. Fulton Ave., Mt. Vernon, N. Y.—DDY
Kurman Electric Co., 35-18 37 St., Long Island City 1, N. Y.—DDS
K. V. Transformer Corp., 4412 Park Ave., New York 57, N. Y.—DEB, DEC, DED
Kyle Corp., S. Milwaukee, Wisc—DEC
Langevin Mfg. Corp., 37 W. 65 St., New York 23, N. Y.—DDM, DEB, DEC, DED
Lapp Insulator Co., Gilbert St., Le Roy, N. Y.—DDH
Leach Relay Co., 5915 Avalon Blvd., Los Angeles 3, Calif—DDQ, DDR, DDS
Lectrohm, Inc., 5560 Northwest Hwy., Chicago 30, Ill—DDI
Lenkurt Electric Co., 1105 County Rd., San Carlos, Calif—DDN, DEB
Lenz Electric Mfg. Co., 1751 N. Western Ave., Chicago 47, Ill—DDA
Leonard Electric Products Co., 67 34th St., Brooklyn 32, N. Y.—DDN, DEB, DEC, DED
Legri S Co., 158 W. 99 St., New York 25, N. Y.—DDI, DDV
Leland, Inc., G. H., 123 Webster St., Dayton 2, Ohio—DDP, DDY, DDZ
Linell Engineering Corp., Oak Park, Ill—DDO
Lionel Corp., Irvington, N. J.—DDK, DDP, DDQ, DDR, DDS, DDY, DEA, DEB, DEC
Lumenite Electronic Co., 407 S. Dearborn St., Chicago 5, Ill—DDS, DDY, DEA
Luther Electronic Mfg. Co., 5767 W. Adams Blvd., Los Angeles 16, Calif—DDD
McIntosh Lab., Inc., 320 Water St., Binghamton, N. Y.—DEB
Magnavox Co., Bueter Rd., Ft. Wayne 4, Ind—DDB, DEB, DEC
Mallory & Co., P. R., 3029 E. Washington St., Indianapolis 6, Ind—DDC, DDD, DDE, DDF, DDG, DDI, DDM, DDP, DDU, DDV, DDW, DDY, DDZ, DEA
Mark Products Co., 3547 Montrose, Chicago, Ill—DDQ
Maxson Corp., W. L., 460 W. 34 St., New York 1, N. Y.—DDW
Melco Products, Inc., 22 E. Hennepin Ave., Minneapolis 1, Minn—DEC
Mepco, Inc., Morristown, N. J.—DDU
Merit Coil & Transformer Corp., 4427 N. Clark St., Chicago 40, Ill—DDI, DDM, DDN, DDO, DEB, DEC
Micamold Products Corp., 1087 Flushing Ave., Brooklyn, N. Y.—DDD, DDG, DDV
Mico Instrument Co., 80 Trowbridge St., Cambridge 38, Mass—DDN
Microlab, 301 S. Ridgewood, S. Orange, N. J.—DDM
Midwest Coil & Transformer Co., 1624 N. Halsted St., Chicago 14, Ill—DEB, DEC, DED
Millen Mfg. Co., James, 150 Exchange St., Malden 48, Mass—DDO
Miller Co., B. F., Box 568, Trenton, N. J.—DDN
Miller Co., J. W., 5917 S. Main St., Los Angeles 3, Calif—DDM, DDN, DDO
Minn.-Honeywell Regulator, Micro Div., Freeport, Ill—DDW, DDX, DDY
Model Engineering & Mfg. Inc., 257 E. Park Dr., Huntington, Ind—DDC
Modulation Products Co., 56 Lispenard St., New York 13, N. Y.—DDE, DDF
Monarch Mfg. Co., 2014 N. Major Ave., Chicago 39, Ill—DDN
Mucon Corp., 9 St. Francis St., Newark 5, N. J.—DDC
Mullenbach Electric Mfg., 2300 E. 27 St., Los Angeles, Calif—DEC
Muter Co., 1255 S. Michigan Ave., Chicago 5, Ill—DDC, DDI
National Co., Malden, Mass—DDB
Nazareth Transformer Corp., 12 North St., Danbury Conn—DEC
Neomatic Inc., 9010 Bellanca Ave., Los Angeles 45, Calif—DDQ, DDR, DDS, DDT
Neptune Electronics Co., 433 Broadway, New York 13, N. Y.—DDF, DDG, DDM, DDI, DDV
Network Mfg. Corp. 213 W. 5 St., Bayonne, N. J.—DDW
North Electric Mfg. Co., 501 S. Market St., Galion Ohio—DDQ, DDR, DDS, DEC
Nothelfer Winding Lab., 118 Albemarle Ave., Trenton, N. J.—DEC
Ogden Coil & Transformer Co., 2130 W. Carroll Ave., Chicago 12, Ill—DEB, DEC, DED
Ohio Carbon, 12508 Berea Rd., Cleveland, Ohio—DDI
Ohmite Mfg. Co., 4835 W. Flournoy St., Chicago 44 Ill—DDU, DDV, DDY
Okonite Co., Passaic, N. J.—DDA
Orthon Corp., 196 Albion Ave., Paterson 2, N. J.—DDM, DDN
Osborne Transformer Corp., 948 E. Lafayette Ave., Detroit 7, Mich—DDN, DEC
Pacific Transducer Corp., 11921 S. W. Pico Blvd., Los Angeles 64, Calif—DEB
Parts Producing Corp., Manhattan Div., 1861 2 Ave., New York 28, N. Y.—DDF, DDJ, DDR, DDW
PCA Inc., 6368 DeLongpre Ave., Hollywood 28, Calif.—DDN, DDO, DEB, DEC, DED, DEF
Peerless Electrical Products, 6920 McKinley Ave., Los Angeles 1, Calif—DEB
Penn-Tran Corp., Bellefonte, Pa—DDN, DEB, DEC
Permoflux Corp., 4900 W. Grand Ave., Chicago 39, Ill.—DDR, DEB
Phalo Plastics Corp., 25 Foster St., Worcester 4, Mass—DDA
Phaostron Co., 151 Pasadena Ave., S. Pasadena, Calif.—DDQ, DDS
Phillips Control Corp., 84 W. Jefferson St., Joliet, Ill.—DDQ, DDR, DDS, DDT
Philmore Mfg., 113 University Pl., New York 3, N. Y.—DDD, DDE, DDG, DDZ, DEB, DEC
Planet Mfg. Co., 225 Belleville Ave., Bloomfield, N. J.—DDD
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Precision Resistor Co., 334 Badger Ave Newark 8 N J —DDO
Price Electric Corp., Church & 2 Sts., Frederick, Md —DDQ DDR DDS, DDT
Pyramid Electric Co., 1445 Hudson Blvd., N Bergen N J—DDD DDF, DDG
Radio Corp. of America, RCA Tube Dept., Harrison N J DDL, DEC, DED
Radio Materials Corp., 3324 N California Ave., Chicago 18, Ill—DDC, DDE
Radio-Music Corp., 84 S Water St Port Chester N Y —DEB, DEC
Radio Receptor Co., 251 W 19 St., New York 11, N Y —DDP
Ram Eectronics, Inc., S Ruckout St., Irvington-On-Hudson N Y—DDL, DEB, DED
R-B-M Div., Essex Wire Corp., Hanna & Chestnut, Logansport, Ind—DDQ, DDR DDS
Recora Co., 7419 S. Western Ave., Chicago 36 Ill —DDY, DEA
Relay Sales, 4721 W Madison St., Chicago 44 Ill—DDQ, DDR, DDS, DDT
Resdel Engineering Corp., 2351 Riverside Dr., Los Angeles 39, Calif —DDM
Resistance Products, 714 Race, Harrisburg Pa —DDU
Rex Rheostat, 3 Foxhurst Rd., Baldwin N Y—DDV
Reynolds Electronics Corp., 507 West St., New York 14, N Y.—DDC
Rhodes, Inc., M H., 30 Bartholomew Ave., Hartford 6, Conn—DEA
Roanwell Corp., 662 Pacific St., B'klyn N Y—DDW
Rockbestos Products Corp., 285 Nicoll St., New Haven 4, Conn—DDA
Rome Cable Corp., Ridge St., Rome, N Y—DDA
Runzel Cord & Wire Co., 4723 W Montrose Ave Chicago 41, Ill.—DDA
Sangamo Electric Co., Capacitor Div., Marion Ill —DDD DDE DDF, DDG
Schuttig & Co., 9 & Kearney Sts N E Washington 17 D C—DDQ
Shallcross Mfg. Co., Pusey & Jackson Aves., Collingdale Pa—DDV, DDZ
Sickles Co., F W., Div General Instrument Corp., 165 Front St., Chicopee, Mass—DDO
Sigma Instruments Inc., 170 Pearl St., S. Braintree Boston Mass—DDR
SNC Mfg. Co., Box 277 Oshkosh Wisc—DEB, DEC
Solar Mfg. Corp., 2660 E 46 St., Los Angeles 58 Calif—DDF DDE
Sound Sales & Engineering Co., 2005 LaBranch Houston 3 Tex—DDA DEB
Southwestern Industrial Electronics Co., 2831 Post Oak Rd Houston 19 Tex—DDN, DEB, DEC
Specialties, Inc., Skunks Misery Rd., Syosset L. I. N Y—DEB DEC DED
Sprague Electric Co., 233 Marshall St N Adams Mass —DDC DDD, DDI
Square D Co., 4041 N Richards St Milwaukee 12 Wisc—DDK, DDS, DDT DDY DEA
Square Root Mfg. Co., 391 Saw Mill River Rd Yonkers 2 N Y—DDN DDO, DEB DEC DED
Stackpole Carbon Co., St Marys Pa—DDV
Standard Arcturus, 54 Clark, Newark, N J—DDP
Standard Coil Products Co., 2329 N Pulaski Rd Chicago 39 Ill—DDM DDO
Standard Electrical Products Co., 400 E 1st St., Dayton 2, Ohio—DEB, DEC
Standard Electronics Corp., 285 Emmet St., Newark 5 N J—DEB DEC
Standard Electronics Mfg. Co., 11861 Teale St., Culver City, Calif—DDV
Standard Transformer Corp., 3580 Elston Ave., Chicago 18 Ill—DEB DEC, DED
Standard Winding Co., 44 62 Johnes St Newburgh N Y—DEB, DEC
Stevens-Arnold, 22 Elkins, S. Boston, Mass—DDR
Stromberg-Carlson Co., 1225 Clifford Ave., Rochester N Y—DDR
Struthers-Dunn, Inc., 150 N 13 St Philadelphia 7, Pa—DDK, DDQ DDR DDS
Super Electric Products Corp., 46 Oliver St., Newark, N J—DEB
Switchcraft, 1328 N. Halsted, Chicago, Ill—DDW
Syntronic Instruments, Inc., 100 Industrial Rd., Addison Ill—DDL, DED
Tartak-Stolle Electronics, 3970 S Grand Ave., Los Angeles 37, Calif—DDM, DDN, DDO, DEB, DEC DED
Tarzian, Inc., Sarkes, Rectifier Div., 415 N College Ave Bloomingdale, Ind—DDP
Tech Labs., Inc., Bergen & Edsall Blvd., Palisades Park N J—DDZ, DEA
Telechrome, Inc., 88 Merrick Rd., Amityville, L. I., N. Y.—DED
Telectro Industries Corp., 35 16 37 St., Long Island City 1, N Y—DDM DEB DEC DED
Teletronic Laboratories, Inc., 1835 W Rosecrans Ave., Gardena Calif—DDA
Telex, Inc., Telex Park St. Paul Minn—DDU
Tel-Rad, Fennimore, Wisc—DDQ, DDR DEC
Tetrad Co., 4054 Ocean Park Ave., Venice Calif —DDM, DDN DEB DEC, DED
Thermador Electrical Mfg. Co., 5119 District Blvd Los Angeles 22 Calif—DDN, DEB, DEC
Thor Transformers & Electronics, 750 San Antonio Rd Palo Alto Calif—DEC
Thordarson-Meissner Mfg. Div., Maguire Industries, Ind., 7 & Belmont Mt Carmel Ill—DDL DEB DEC
Todd-Tran Corp., 752 S 3rd Ave Mt Vernon N Y. —DDL, DEB DEC
Transformer Engineers, 161 E Calif St., Pasadena 1, Calif—DEC
Transformer Technicians, Inc., 2608 N Cicero Ave., Chicago 39, Ill—DEB, DEC, DED
Trenton Transformer Corp., Box 568, Trenton, N J —DDN, DEB, DEC
Triad Transformer Mfg. Co., 4055 Redwood Ave, Venice, Calif—DDN, DEB, DEC
Tri-Dex Co., Box 1207, Lindsay, Calif—DDN, DDO
Triumph Mfg. Co., 913 W. Van Buren St., Chicago 7, Ill—DDL
Tru-ohm Products, Div. Model Eng'g. & Mfg., Inc., 2800 N. Milwaukee Ave., Chicago 18, Ill—DDU DDV
T-V Products Co., 152 Sanford St., Brooklyn 5, N. Y. —DDM

Ulanet Co., George, 413 Market St., Newark 5, N. J. —DEA
U. S. Rubber Co., 1230 Avenue of the Americas New York, N. Y.—DDA
United Transformer Co., 150 Varick St New York 13, N Y—DEB, DEC, DED
Utah Radio Products Co., 1123 E Franklin St., Huntington, Ind—DEB, DEC, DED
Variable Condenser Corp., 63 Hope St., Brooklyn 11, N Y—DDF
Vacuum Tube Products, 506 S Cleveland St., Oceanside Calif—DDJ
Varo Mfg. Co., 1801 Walnut St., Garland Tex—DEC
Vickers Elec., 1815 Locust St Louis, Mo—DDP
Vincent Co., A. W., 163 St Paul St., Rochester 4, N Y—DDR, DDT
Vitramon, Inc., Stepney, Conn—DDI
Vokar Corp., 7300 Huron R Dr Dexter Mich—DDM
Wadsworth Mfg. Associates, 509 Balsam St., Liverpool, N Y—DDR
Ward Leonard Electric Co., Mt Vernon N Y—DDQ DDS DDU, DDV
Welch Electric Co., 1221 Wade St., Cincinnati 14, Ohio—DDQ DDR DDS DDT DDZ
Wells Sales, Inc., 833 W Chicago Ave., Chicago 22 Ill—DDW
Wilkor Products Inc., 3835 W 150 St., Cleveland 11, Ohio—DDL
Wirt Co., 5221 Greene St Germantown, Philadelphia 44, Pa—DDO, DDU, DDV
Wright Zimmerman, Inc., 330 5 Ave New Brighton 8 Minn—DDR
Yonkers Industries, Inc., Subs. Electronic Designs, Inc., 28 School St., Yonkers N Y—DDI

30—Services

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Dubbing, sound .... **EEC**
Effects record, sound .... **EED**
Equipment theater TV .... **EEE**
Kinescoping .... **EEF**
Laboratories, film processing .... **EEG**
Libraries, record .... **EEH**
Libraries, tape music .... **EEI**
Materials, special effects .... **EEJ**
Production, film .... **EEK**
Production, slides .... **EEL**
Production, TV spot film .... **EEM**
Production, transcriptions .... **EEN**
Property & scenery, TV .... **EEO**
Rental, motion picture equipment ..... **EEP**
Rental, TV film .... **EEQ**
Services, film editing, titling, etc. .. **EER**
Services, frequency measuring .... **EES**
Services, news .... **EET**
Services, program .... **EEU**
Services & repairs, special optical & motion picture .... **EEV**
Stages, sound .... **EEW**
Studios, film .... **EEX**

Academy Film Production, 123 W Chestnut St., Chicago, Ill—EEK
Acme Telectronix Div., NEA Service, Inc., 1200 W 3rd St Cleveland, Ohio
Aero Electronics Co., 1512 N Wells St., Chicago 10 Ill—EER
Affiliated Film Producers, 164 E 38th St., New York 16, N. Y—EEL
Airplane & Marine Instruments, Clearfield Pa—EEA
Alexander Film Co., Alexander Film Bldg., Colorado Springs, Colo—EEG EEK EEM EEQ EEW, EEX
Allen & Allen Productions, 3947 W 50th Pl., Los Angeles 43, Calif—EEK, EEM, EER, EEQ, EEU, EEW, EEX
Allied Record Mfg. Co., 1041 N Las Palmas Ave., Hollywood 38, Calif—EEN
Ambassador Films, Inc., 118 W 57th St., New York 19, N Y.—EEK
American Electroneering Corp., 5025 W Jefferson Blvd., Los Angeles 16, Calif—EES
American Film Producers, 1600 Broadway New York 19, N Y—EEK
Animated Productions, 1600 B'dway New York, N Y. —EEK
Apex Film Corp., 971 N La Cienega Blvd., Los Angeles 46, Calif—EEK
Archer Productions, Inc., 35 W. 53rd St New York 19, N Y—EEK
Associated Electronics Co., 132 Nassau St New York 7, N. Y—EEB, EEK EEM EEL, EEN, EER, EET EEU EEV
Atlantic Electronics Corp., 4 Manhasset Ave Port Washington, N Y—EEA EEB
Atlantic Video Corp., 18 Clinton B'klyn, N Y—EER
Atlas Film Corp., 111 S. Blvd Oak Park, Ill—EEK
Audio Equipment Sales, Div. F. Sumner Hall, Inc., 153 W 33 St., New York 1, N Y—EEB
Audio Instrument, 133 W. 14 St New York, N. Y. —EEB
Audio Productions, Inc., 630 Ninth Ave., New York 19, N Y—EEK
Audio & Video Products Corp., 730 Fifth Ave New York 1, N Y.—EEA EEB EEC EED EEI, EEJ EEK, EEL, EEM, EEN EEP, EEQ, EEW
Background Engineers, 6611 Santa Monica Blvd., Hollywood 38, Calif—EEI
Baldwin, Ted, 270 Park Ave, New York, N Y—EEK
Bardwell & McAlister, 2950 N. Ontario St., Burbank, Calif.—EEA, EEB
Bram Instruments Corp., 350 Fifth Ave., New York 1, N Y—EEB
Beeland Co., Charles D., 324 Walton Bldg., Atlanta 3, Ga—EEC EEH, EEK EEM EEN EER EEX
Bell Sound Systems, Inc., 55 Marion Road, Columbus 7, Ohio—EEB

Berkeley Custom Electronics, 2571 Shattuck Ave Berkeley 4, Calif—EEA EEB
Berman & Bettenbender, 410 S Michigan Ave., Chicago Ill—EEK
Bogen Co., D., 29 9th Ave., New York, N. Y—EEI
Bowman Films, Inc., 360 N. Michigan Ave., Chicago 1 Ill—EEK
Bray Studios, 729 7th Ave., New York 19, N. Y —EEI, EEM EER, EEV
Brinkley Recording Co., 232 E. Erie St., Chicago 11 Ill—EEC EEK, EEM EER EEW EEX
Broidy Productions, Inc., William F., 5545 Sunset Blvd Hollywood 28, Calif—EEK
Byron, Inc., 1226 Wisconsin Ave., N W., Washington D C—EEC, EEK, EEM EER EEV, EEW
Burnett Radio Lab., Wm. W. L., 4814 Idaho St San Diego 16, Calif—EES
Calvin Mfg., 15th St E., Kansas City, Mo—EEK
Camburn, Inc., 32 40 57 St., Woodside N Y—EEA
Camera Equipment Co., 1600 Broadway, New York 19 N. Y—EEP, EEV
Camera Mart, Inc., 1845 Broadway, New York 23, N Y—EEP, EEV
Camfield Mfg. Co., Seventh St., Grand Haven Mich —EES
Campbell-Cahill Studio, 360 N Michigan Ave., Chicago 1, Ill—EEK
Capitol Records, Inc., Broadcast Div., Sunset & Vine Hollywood 28, Calif—EEN
Caravel Films, 730 5th Ave., New York 19, N. Y—EEK
Cardinal Co., 6000 Sunset Blvd., Hollywood 28, Calif —EEK EEM, EEV, EEX
Cascade Pictures of Calif., 8822 Washington Blvd., Culver City, Calif—EEK
C & G Film Effects, 1600 Bway, New York 19, N. Y —EEI EEK EEM EER
Chase Electronics Laboratory, 128 N Fair Oaks Ave., Pasadena 1, Calif—EEA EEB
Chicago Film Laboratory, Inc., 56 E Superior St., Chicago 11, Ill—EEK
Church Productions, Arthur B., Pickwick Hotel, Kansas City 6, Mo—EEK EEQ EEV
Cineffects, 115 W 45th St., New York, N. Y—EER
Cinema Research Corp., 7000 Romaine St Hollywood 38 Calif—EEG EER
Cinemart, Inc., 322 E 44th St., New York 17, N. Y —EEC EER EEW EEX
Cinescope Films, 42 45 160th St., New York 36, N Y —EEK
Cine-Tele Productions, 1161 N Highland Ave., Hollywood 38 Calif—EEG, EEK, EEM, EER
Colburn Laboratory, Inc., George W., 164 N Wacker Drive, Chicago 6, Ill—EEC, EEG, EEK, EEM, EEL EEN, EER EEV EEX
Colonial Films, 1989 N George Mason Dr., Arlington, Va—EEC, EEF, EEG, EEK, EEM, EER, EET, EEV, EEW EEX
Columbia Records, Inc., 700 Seventh Ave., New York 19, N Y—EEH, EEN
Columbia Transcriptions, 700 7th Ave., New York 19, N Y—EEN
Cousens, Clayton W., 152 W 42nd St., New York 22, N Y—EEK
Commodore Productions & Artists, Inc., 1350 N Highland Ave., Hollywood 28, Calif.—EEK
Commonwealth Film & Television Inc., 732 Seventh Ave New York 19, N. Y.—EEQ
Consolidated Film Industries, Div. of Republic Pictures Corp., 1740 Broadway, New York, N. Y—EEK
Constable Engineering Co., J. M., 101-05 77 St., Ozone Park 17, N. Y—EEA
Crosby Enterprises, Inc., 9028 Sunset Blvd., Hollywood 46, Calif—EEK
Culhane Productions, Shamus, 207 E 37th St., New York N Y—EEK EEM EEQ EEV
Custom Craft Mfg. Co., 256 E 98th St Brooklyn 12, N. Y—EEA EEB
Dage Electronics Corp., 69 N Second St., Beech Grove, Ind—EEA
Damon Recording Studios, Inc., 117 W 14 St., Kansas City 6, Mo—EEC EED EEJ, EEN
Daven Co., 193 Central Ave., Newark 4, N J—EEA EEB
Dawson, Stuart V., 520 N Michigan Ave., Chicago, Ill —EEK
Day Productions, Gordon M., 108 E 30th St., New York 16, N Y—EEK, EEM EEN EEV
Decca Records, Inc., 50 W. 57th St., New York 19, N Y—EED, EEN
DeFrenes Co., 1909 Buttonwood St., Philadelphia 30, Pa—EEK
De Luxe Labs., 850 10th Ave., New York, N. Y.—EEK
Demby, Brown & Co., 34 E 51st St., New York 22, N. Y—EEK
Douglas Productions, 1425 S. Racine Ave., Chicago, Ill —EEK
DePhoure Studios, 782 Commonwealth Ave., Boston 15, Mass—EEK
Depicto Films, Inc., 254 W. 54th St., New York 19, N Y—EEK
Disney Productions, Burbank Calif—EEK
Dittmore & Freimuth Co., 2517 E Norwich St., Cudahy, Wisc.—EEB
Du Art Film Labs., 245 W 55th St., New York, N Y —EEK
Dubois Co., Jean, 2214 Dahlia St., Denver 7, Colo —EEK
Dudley Television Corp., 9908 Santa Monica Blvd Beverley Hills Calif—EEK EEM
Dynamic Films, Inc., 112 W 89th St New York 24 N Y—EEC EEF EEK EEM EER EET EEW EEX
Eastman Kodak Co., 343 State St., Rochester 4, N Y —EEC, EEF, EEK, EEM, EER EET EEW, EEX
EDL Co., 5929 East Dunes Hiway, Miller Station, Gary Ind—EEG, EEV
Education Films Corp. of Amer., 1501 Broadway, New York 36 N Y—EEK
Eldson Electronic Co., 1802 N Third St., P O Box 31, Temple, Tex—EES
Electrical Tower Service, Peoria Ill—EEA
Electron Enterprises, 6917 W. Stanley Ave., Berwyn, Ill.—EEA
Electronic Development Laboratory, 43-07 23 Ave., Long Island City 5, N. Y—EEA EEB EES, EEV
Electronic Tube Corp., 1200 E Mermaid Lane, Philadelphia 18, Pa—EEA, EEB
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Engineering Research & Development Co., Box 166, Hinsdale, Ill.—EER
Equipment & Service Co., 6815 Oriole Dr., Dallas 9, Tex.—EEA, EER
Explorers Pictures Corp., 1501 Broadway, New York 36, N. Y.—EEK
Fairbanks, Inc., Jerry, 6052 Sunset Blvd., Hollywood 28, Calif.—EEK, EEM
Fairfield Films, Inc., 40 E. 51st St., New York 22, N. Y.—EEK
Famous Artists Corp., 9441 Wilshire Blvd., Beverley Hills, Calif.—EEK
Federated Television Productions, 10 E. 10th St., New York, N. Y.—EEK, EEM, EER, EEW, EEX
Fennell Co., Paul J., 1159 N. Highland Ave., Hollywood 38, Calif.—EEK
Ferrar Radio & Television Corp., 55 W. 26 St., New York 10, N. Y.—EEA, EER
Filmack Trailer Corp., 1327 S. Wabash Ave., Chicago 5, Ill.—EEC, EEG, EEK, EEL, EEM, EER, EEX
Film Associates, Inc., 440 E. Schantz Ave., Dayton 9, Ohio—EEC, EED, EEF, EEG, EEH, EEK, EEL, EEM, EEN, EEP, EER, EEW, EEX
Filmcraft Productions, 8451 Melrose, Hollywood, Calif.—EEK
FilmEffects of Hollywood, 1153 N. Highland Ave., Hollywood, Calif.—EEJ, EEM
Film Features Associates, 661 West End Ave., New York 25, N. Y.—EEK, EEM, EEN, EEU
Film Graphics, 245 W. 55th, New York, N. Y.—EEK
Filmlab, 126 W. 46th St., New York, N. Y.—EEK
Films for Industry, 135 W. 52nd St., New York 19, N. Y.—EEK
Fine Sound, Inc., Tomkins Cove, N. Y.—EEA, EEB, EEC, EED, EEH, EEI, EEJ, EEK, EEM, EEN, EET, EEW, EEX
Fish-Schurman Corp., 70 Portmand Rd., New Rochelle, N. Y.—EEK, EEJ
Five Star Productions, 6526 Sunset Blvd., Hollywood 28, Calif.—EEK, EEM, EEV
Flett Laboratory, 3741 Marshall Road, Drexel Hill, Pa.—EEA, EEB
Flexon Products Corp., 219 W. 34th St., New York 1, N. Y.—EEJ, EER
Florez, 815 Bates St., Detroit 26, Mich.—EEK
Fox Movietone News, 460 W. 54th St., New York, N. Y.—EEK, EET
Freed Transformer Co., 1718 Weirfield St., 1718 Weirfield St., Brooklyn 27, N. Y.—EEB
Frutchey, M., Box 28, Hackettstown, N. J.—EEA, EER
Funt Radio Production, Allen A., 100 Central Park S., New York 17, N. Y.—EEK, EEM
Gamble Productions, Inc., 129 E. 54th St., New York, N. Y.—EEK, EET, EEQ
Ganz Co., William J., 40 E. 49th St., New York 17, N. Y.—EEK
General Pictures Productions, 621 Sixth Ave., Des Moines 9, Iowa—EEC, EEG, EEK, EER
General Precision Lab., Inc., 63 Bedford Rd., Pleasantville, N. Y.—EEK, EEF
Harold R. Gingrich, 520 N. Michigan Ave., Chicago, Ill.—EEK
G-L Enterprises, Inc., 270 Park Ave., New York 17, N. Y.—EEK
Goodman Radio & TV Productions, Harry S., 19 E. 53rd St., New York 22, N. Y.—EEK, EEM, EEV, EEK
Gorrell & Gorrell, 336 Old Hook Rd., Westwood, N. J.—EEA
Gotham Recording Corp., 2 W. 46 St., New York 36, N. Y.—EEA, EEN, EEP, EEV, EEW
Gray-O-Reilly Studios, 480 Lexington Ave., New York, N. Y.—EEK, EEM
Guffanti Film Labs., Inc., 630 9th Ave., New York, N. Y.—EEK
Gulton Mfg. Corp., 212 Durham Ave., Metuchen, N. J.—EEB
G & W Television Productions, Inc., 307 E. 44th St., New York 17, N. Y.—EEK
Handy, Jam Organization, 2821 E. Grand Blvd., Detroit 11, Mich.—EEB, EEC, EED, EEJ, EEK, EEM, EEL, EEN, EEO, EEP, EEQ, EER, EEV, EEW, EEY
Hankinson Studio, 15 W. 46th St., New York, N. Y.—EEK
Hart, Arthur H., 2125 32 Ave., San Francisco 16, Calif.—EEI
Hartley Productions, 20 W. 47th St., New York 19, N. Y.—EEK, EEV
Hartman Engineering Co., 117 Oakland St., Springfield, Mass.—EEA
Harvey-Wells Electronics, Inc., North St., Southbridge, Mass.—EEA, EEB
Heller & Associates, Herman S., 8414 W. 3 St., Los Angeles 48, Calif.—EEC
Holbert Productions, 1564 Broadway, New York 19, N. Y.—EEK
Houston-Fearless Corp., 11801 W. Olympic Blvd., West Los Angeles 64, Calif.—EEG
Hycon Mfg. Co., 2961 E. Colorado St., Pasadena 8, Calif.—EEA
Hycor Co., 11423 Vanowen, N. Hollywood, Calif.—EEB
Industrial Electronic Engineers, 5973 Lankershim Blvd., N. Hollywood, Calif.—EEA, EEB
Int'l Movie Producer's, 515 Madison Ave., New York 22, N. Y.—EEH, EEM, EEP, EER, EEW, EEX
International News Service, 235 E. 45th St., New York 17, N. Y.—EET
Int'l Research Associates, A Div. of Iresco Inc., 2221 Warwick Ave., Santa Monica, Calif.—EES
International Tele-Film, Inc., 331 Madison Ave., New York 17, N. Y.—EEK
Intervox Corp., 1846 Westlake N., Seattle 9, Wash.—EEA, EEB
Ivanhoe Electronic Laboratories, 14238 S. LaSalle St., Chicago 27, Ill.—EES
Jarvis Electronics, 6058 W. Fullerton Ave., Chicago 39, Ill.—EEA
Jewell Radio & Television Productions, 185 N. Wabash Ave., Chicago, Ill.—EEK
Jones Productions, Dallas, 1725 N. Wells St., Chicago, Ill.—EEK
Kalbfell Laboratories, Inc., P. O. Box 1578, San Diego 10, Calif.—EEA
Kaleb Film Co., 19 W. 45th, New York, N. Y.—EEK
Kenco Productions, 333 W. 52nd, New York, N. Y.—EEK
Kerkow, H., 480 Lexington Ave., New York, N. Y.—EEK
Kling Studio, Inc., 601 N. Fairbanks Ct., Chicago, Ill.—EEC, EEF, EEK, EEM, EEL, EEN, EEO, EEQ, EER, EET, EEU, EEW, EEX
Knickerbocker Productions, 1600 Broadway, New York 19, N. Y.—EEK, EEM, EEL, EER
Kollmorgen Optical Corp., 2 Franklin Ave., Brooklyn 11, N. Y.—EEV
Korb Engineering & Mfg. Co., 30 Ottawa Ave., Grandville, Mich.—EEB
Lalley & Love, Inc., 3 E. 57th St., New York 22, N. Y.—EEK
Langevin Mfg. Corp., 37 W. 65 St., New York 23, N. Y.—EEB
Lang-Worth Feature Programs, 113 W. 57th St., New York 19, N. Y.—EEC, EEH, EEV, EEX
Las-Lab, 316 W. Saratoga St., Baltimore 1, Md.—EEV
Laufman & Co., Herbert S., 624 S. Michigan Ave., Chicago, Ill.—EEK
Laurence Productions, Robt., 118 W. 54th St., New York, N. Y.—EEK
Lehman, Harry, 1161 N. Highland Ave., Hollywood 38, Calif.—EEK, EEM
Lewis Sound Films, 75 W. 45th, New York, N. Y.—EEK
Libra Film & Equipment, 6525 Sunset Blvd., Hollywood 28, Calif.—EEK, EEL, EEM, EEQ, EER, EET, EEU
Lion Television Pictures, 1501 Broadway, New York 36, N. Y.—EEK
Lloyds Film Storage Corp., 729 Seventh Ave., New York, N. Y.—EEJ, EEP
London Film Productions, 350 5th Ave., 148 W. 57th St., New York, N. Y.—EEK, EEQ, EEU
Loucks & Norling Studios, Inc., 245 W. 55th St., New York 19, N. Y.—EEK, EEM, EEL, EER, EEV

Using the Index

An alphabetical manufacturers' index and a separate product index have been prepared for your convenience. The product index appears on page 115 and the index of manufacturers begins on page 119.

MCA TV Ltd., 430 N. Michigan, Chicago, Ill.—EEK
Magna Electronics Co., 9810 Anza Ave., Box 338, Inglewood, Calif.—EEA, EEB
Magnecord, 225 W. Ohio St., Chicago, Ill.—EEI
Magnetic Recording Industries, 20 Broad St., New York 4, N. Y.—EEB
Mannon Sound Stages, Inc., 112 W. 89th St., New York 24, N. Y.—EEC, EEO, EER, EEW, EEX
March of Time, Television, (Div. of Time, Inc.) 369 Lexington Ave., New York 19, N. Y.—EEK
Master Motion Picture Co., 50 Piedmont St., Boston 16, Mass.—EEK
Maurer, Inc., J. A., 37-01 31 St., Long Island City 1, N. Y.—EEC, EEO, EEG
Maxwell Associates, Robert, 480 Lexington Ave., New York 17, N. Y.—EEK, EEV
McGeary-Smith Labs., Inc., 1905 Fairview Ave., N. E. Washington 2, D. C.—EEK
McLarty Pictures Productions, 45 Stanley St., Buffalo 6, N.Y.—EEK
Mecca Film Labs., 630 9th Ave., New York, N. Y.—EEK
Mercury Film Labs., Inc., 723 7th Ave., New York, N. Y.—EEK
Mercury International Pictures, 1415 Coast Blvd., Corona del Mar, Calif.—EEK
Michelson, Inc., Charles, 15 W. 47th St., New York 19, N. Y.—EEK
Micro Eng'g Corp., 6233 Hollywood Blvd., Hollywood 28, Calif.—EEA, EEC, EEE, EEF, EEG, EEK, EEL, EEM, EEN, EER, EEV, EEX
Mode-Art Pictures, Inc., 1022 Forbes St., Pittsburgh 19, Pa.—EEK
Morton Television Productions, 360 N. Michigan Ave., Chicago, Ill.—EEK
Motion Picture Productions, Sixth & Superior Sts., W. Cleveland 13, Ohio—EEK
Movie Advertising Bureau, United Film Service, 333 N. Michigan Ave., New York, N. Y.—EEK
Movielab Film Labs., Inc., 619 W. 54th St., New York, N. Y.—EEK
MP Concert Installations, Fairfield, Conn.—EER, EEE
MPO Productions, 15 E. 53rd St., New York, N. Y.—EEK
Murphy-Lillis Productions, 723 7th Ave., New York, N. Y.—EEK, EEM
Musicolor, Inc., 840 N. Michigan Ave., Chicago 11, Ill.—EEJ, EEO, EEQ
National Screen Service Corp., 1600 Broadway, New York, N. Y.—EEK
National TV Laboratories, 4350 Lankersheim Blvd., N. Hollywood 16, Calif.—EEK, EEM
Nemeth Studios, Ted, 729 7th Ave., New York 19, N. Y.—EEK, EEM
Nu-Art Films, 112 W. 48th St., New York, N. Y.—EEK
O'Brien Electric Co., 6514 Santa Monica Blvd., Hollywood 38, Calif.—EEA
Official Television, Inc., 25 W. 45th St., New York 19, N. Y.—EEK, EEM
Olio Video Television Productions, 30 E. 42nd St., New York 17, N. Y.—EEK
Orleans & Associates, Inc., Sam, 211 W. Cumberland Ave., Knoxville 15, Tenn.—EEK
Pacific Mercury Television Mfg., 5955 Van Nuys Blvd., Van Nuys, Calif.—EEA, EEB
Packaged Programs, Inc., 634 Penn Ave., Pitsburgh 22, Pa.—EEG, EEK, EEM, EEL, EEN, EER, EET, EEU
Page, Television Productions, Sidney L., 203 N. Wabash Ave., Chicago, Ill.—EEK
Paramount TV Productions, Inc., 1501 Broadway, New York 18, N. Y.—EEK, EEF, EEX
Pathe Laboratories, 105 E. 106th St., New York, N. Y.—EEG, EEK
Pathescope Co. of America, 580 Fifth Ave., New York 19, N. Y.—EEK, EEM
PCA Inc., 6368 DeLongpre Ave., Hollywood 28, Calif.—EEA, EEB, EES
Philco Corp., Government & Industrial Div., 4700 Wissahickon Ave., Philadelphia 44, Pa.—EEA
Pictorial Films, Inc., 1501 Broadway, New York 18, N. Y.—EEK
Post Pictures Corp., 115 W. 45th St., New York 19, N. Y.—EEK
Precision Film Laboratories, Inc., 21 W. 46 St., New York 36, N. Y.—EEG
Princeton Film Center, Carter Rd., Princeton, N. J.—EEK, EEM, EEW, EEX
Prockter, Bernard J., 221 W. 57th St., New York 19, N. Y.—EEK
Radio Laboratories, 1846 Westlake N., Seattle 9, Wash.—EEA, EEB
Radio-Music Corp., 84 South Water St., Port Chester, N. Y.—EEB
Radio Recorders, 7000 Santa Monica Blvd., Hollywood, Calif.—EEB, EEC, EED, EEH, EER, EEW
Radio Sonic Corp., 186 Union Ave., New Rochelle, N. Y.—EEA, EEB
RAM Productions, 661 West End Ave., New York 25, N. Y.—EEN, EEU
Rarig Motion Picture Co., 5514 University Way, Seattle 5, Wash.—EEK
Ray Film Industries, Reid H., 2269 Ford Parkway, St. Paul 1, Minn.—EEK
RCA Communications, Inc., 66 Broad St., New York 4, N. Y.—EES, EEU
RCA Recorded Program Services, 630 5th Ave., New York, N. Y.—EEC, EEH, EEN, EEI
Recorders Labs, Inc., 6916 Santa Monica Blvd., Hollywood 38, Calif.—EEH
Reed Productions, Inc., Roland, 275 S. Beverley Dr., Beverley Hills, Calif.—EEK
Reeves Sound Studios, 304 E. 44th St., New York 19, N. Y.—EEB, EEC, EEM, EEN, EER, EEW
Remler Co., Ltd., 2101 Bryant St., San Francisco 10, Calif.—EEB
Republic Television Features, 64 E. Lake St., Chicago, Ill.—EEK
RKO-Pathe, 625 Madison Ave., New York 22, N. Y.—EEK, EEM
Roach Studios, Hal, 8822 Washington Blvd., Culver City, Calif.—EEK, EEM
Rocket Pictures Inc., 6108 Santa Monica Blvd., Hollywood 38, Calif.—EEK
Rockett Co., Frederick K., 6063 Sunset Blvd., Hollywood 28, Calif.—EEK
Sherwin, Robert Rodgers, 720 N. Michigan Ave., Chicago, Ill.—EEK
Rolab Photo-Science Labs., Sandy Hook, Conn.—EEK
Rosen Eng'g Prods. Raymond, 32 & Walnut Sts., Philadelphia 4, Pa.—EEB
Rowe Industries, 1702 Wayne St., Toledo 9, Ohio—EEB
Royal Recording Co., 601 Ashby Ave., Berkley 10, Calif.—EEC, EEW
Ruby Film Co., 729 Seventh Ave., New York, N. Y.—EEP, EEQ, EER
Rutherford Electronics Co., 3707 S. Robertson Blvd., Culver City, Calif.—EEA
Sackett Productions, Bernard L., Bankers Securities Bldg., Philadelphia 7, Pa.—EEC
Sarra, Inc., 16 Ontario St., Chicago 11, Ill.—EEK, EEA
Schumaker Construction Co., Michigan City, Ind.—EEA
Science Pictures, Inc., 5 E. 57th St., New York 22, N. Y.—EEK
Screen Gems, Inc., 729 7th Ave., New York 19, N. Y.—EEK
Screen Televideo Products, 328 S. Beverley Drive, Hollywood, Calif.—EEK
Seaboard Studios, Inc., 157 E. 69th St., New York 21, N. Y.—EEB
Sealtron Co., The, 9701 Reading Road, Cincinnati 15, Ohio—EEA, EEB
Sellers Co., 9053½ Main St., Dallas, Tex.—EEC, EED, EEI, EEN
Sesac, Inc., 475 Fifth Ave., New York 17, N. Y.—EEH, EEU
Sherwood Pictures Corp., 1569 Broadway, Brooklyn 7, N. Y.—EEQ, EEU
Shevers, Inc., Harold, 12 W. 44 St., New York 23, N. Y.—EEB
Shrader Mfg. Co., 2803 M St., N. W., Washington, D. C.—EEA, EEB
Sierra Electronic Corp., 1050 Brittan Ave., San Carlos, Calif.—EEA, EEB
Simmel-Meservey, Inc., 321 S. Beverly Dr., Beverly Hills, Calif.—EEH, EEK, EEQ, EEU, EEX
Skiatron Electronics & Television, 30 E. 10th St., New York, N. Y.—EEE
Skyline Productions, 127 E. 61st St., New York 21, N. Y.—EEK
Smith Studios, Fletcher, 321 E. 44th St., New York 17, N. Y.—EEK
Snader Productions, 328 S. Beverly Drive, Beverly Hills, Calif.—EEK
S. O. S. Cinema Supply Corp., 602 W. 52 St., New York 19, N. Y.—EEP, EEV
Sound Laboratories, 323 E. 48 St., New York 17, N. Y.—EEB
Sound Masters, Inc., 165 W. 46th St., New York 19, N. Y.—EEK
Sound Sales & Engineering Co., 2005 LaBranch, Houston 3, Tex.—EEA, EEB, EEC, EEK, EEN
Souvaine Co., 30 Rockefeller Plaza, New York 20, N. Y.—EEU
Special Instruments Laboratory Inc., 1003 Highland Ave., Knoxville, Tenn.—EEA
Special Purpose Film, Inc., 44 W. 56th St., New York 19, N. Y.—EEK
Square Root Mfg. Co., 391 Saw Mill River Road, Yonkers 2, N. Y.—EEB
Sterling Television Co., Inc., 316 W. 57th St., New York 19, N. Y.—EEK
Sturm, Bill Studios, 734 Broadway, New York, N. Y.—EEK

Streech, Wilbur Productions, 1697 Broadway, New York 19, N. Y.—EEK
Sun Dial Films, Inc., 341 E. 43rd St., New York 17, N. Y.—EEK, EEM, EEL, EER, EEU, EEW, EEX
Sutherland Productions, Inc., John, 201 N. Occidental Blvd., Los Angeles 26, Calif.—EEK
Swank Films, 627 Salem, Dayton 2, Ohio—EEX
Synchromatic Prods., 766 Broadway, Bayonne, N. J.—EEL, EEM
Tape Recording Apparatus Co., Box 221, Caldwell, N. J.—EER
Tape Recording Industries, 3335 E. Michigan Ave., Lansing, Mich.—EEI
Tech Labs, Inc., Bergen & Edsall Blvd., Palisades Park, N. J.—EEC
Teevee Co., The, 211 S. Beverly Drive, Beverly Hills, Calif.—EEK
Telamerica, Inc., 270 Park Ave., New York 17, N. Y.—EEK
Telecast Films, Inc., 112 W. 48th St., New York 19, N. Y.—EEK
Telechrome, Inc., 88 Merrick Rd., Amityville, L. I., N. Y.—EEE, EEF
Telectro Industries Corp., 35-18 37 St., Long Island City 1, N. Y.—EEA, EER
Telefex, 5919 Hollywood Blvd., Hollywood 28, Calif.—EEL, EEL, EEP, EEU, EEV
Telefilm, Inc., 6039 Hollywood Blvd., Hollywood 28, Calif.—EEC, EED, EEF, EEH, EEK, EEM, EEQ, EER, EEW, EEX
Telemated Cartoons, 70 E. 45th St., New York 17, N. Y.—EEC, EEK, EEM, EEQ, EER
Telenews Productions, Inc., 630 Ninth Ave., New York 19, N. Y.—EEK, EEM, EER, EET, EEU
Telepix Corp., 6233 Hollywood Blvd., Hollywood 28, Calif.—EEC, EED, EEK, EEM, EEL, EEN, EER, EEW, EEX
Television Cartoons, Inc., 155 W. 46 St., New York 13, N. Y.—EEC, EEK, EEM, EEQ, EER
Television Graphics, 245 W. 55th St., New York, N. Y.—EEK
Television Screen Productions, 17 E. 45th St., New York 17, N. Y.—EEK, EEM
Tel-Instrument Co., 50 Paterson Ave., E. Rutherford, N. J.—EEA
Tempo Record Co. of America, 8540 Sunset Blvd., Hollywood 28, Calif.—EEH
Tel Ra Productions, 1518 Walnut St., Philadelphia 2, Pa.—EEK
Times Square Prods., 145 W. 45th St., New York 19, N. Y.—EEK
Tonechek Recordings, 11 Pleasant Pl., Maywood, N. J.—EEA, EEC, EED, EEN
Tower Construction Co., 107 4th St., Sioux City, Iowa—EEA
Transfilm, Inc., 35 W. 45th St., New York 19, N. Y.—EEK, EEM
Transitron, Inc., 154 Spring St., New York 12, N. Y.—EEA
TransLux Corp., 1270 6th Ave., New York 20, N. Y.—EEJ
Transmitter Equipment Mfg. Co., 345 Hudson St., New York 14, N. Y.—EEH
Transvideo Corp. of America, 2 W. 46th St., New York 19, N. Y.—EEK
Tressel Television Productions, Inc., 11 S. La Salle, Chicago, Ill.—EEK, EEM, EEL, EEX
Triad Transformer Mfg. Co., 4055 Redwood Ave., Venice, Calif.—EEB
Tri-Dex Co., Box 1207, Lindsay, Calif.—EEA
Tru-Vue Television Co., 99 Featherbed Lane, Bronx 52, N. Y.—EEA, EEB, EEV
TV-Unlimited, Inc., 341 Madison Ave., New York 17, N. Y.—EEK
Twentieth Century Fox Co., 444 W. 56th St., New York, N. Y.—EEK, EEM
United Broadcasting Co., 301 E. Erie St., Chicago, Ill.—EEK
United Productions of America, 40 W. Olive Ave., Hollywood, Calif.—EEK
United World Films, Inc., 445 Park Ave., New York 22, N. Y.—EEK, EEM, EEL, EEQ
Unity Television Corp., 1501 Broadway, New York 18, N. Y.—EEK
U. S. Recording Co., 1121 Vermont Ave., N. W., Washington 5, D. C.—EEB, EEC
Van Praag Productions, 1600 Broadway, New York 19, N. Y.—EEK
Valentino, Inc., Thomas J., 150 46th St., New York 36, N. Y.—EEC, EED, EEH, EEN, EET
Video Films, 1004 E. Jefferson Ave., Detroit 14, Mich.—EEC, EEK, EEM, EEP, EER
Video Varieties Corp., 41 E. 50th St., New York 22, N. Y.—EEK, EEM, EER, EEW, EEX
Vidicam Pictures Corp., 240 E. 39th St., New York 16, N. Y.—EEK
Visual Methods, Inc., 330 Second Nat'l. Bk. Bldg., Akron, Ohio—EEK
Vogue Wright Studios, 237 E. Ontario St., Chicago 11, Ill.—EEK, EEM, EEL, EEN, EER, EEU, EEX
Walkirt Co., The, 145 W. Hazel St., Inglewood 3, Calif.—EEA, EEB
Waveforms, Inc., 333 Sixth Ave., New York 14, N. Y.—EER
West Coast Sound Studios, 510 W. 57th St., New York 19, N. Y.—EEK, EEM, EEX
Western Instrument Co., 826 N. Victory Blvd., Burbank, Calif.—EEV
Western Sound & Electric Labs., Inc., 805 S. 5th St., Milwaukee 4, Wis.—EEB
Wilding Picture Productions, 1345 Argyle St., Chicago 40, Ill.—EEK, EEM
Willard Pictures, Inc., 45 W. 45th St., New York 19, N. Y.—EEK
Williams, Brown & Earle, Inc., 918 Chestnut St., Philadelphia 7, Pa.—EEP
Wind Turbine Co., E. Market St. & P. R. R., West Chester, Pa.—EEA
Winik Films, Inc., 625 Madison Ave., New York, N. Y.—EEK, EEM
Wolff Studios, Raphael G., 5631 Hollywood Blvd., Hollywood 28, Calif.—EEK
Woodruff Associates, 210 E. 41st St., New York 22, N. Y.—EEK, EEM, EEL, EEO, EEP, EER, EEU, EEV, EEW, EEX
WOR Recording Studios, 1440 Broadway, New York 18, N. Y.—EEN, EEW
World Broadcasting System, 488 Madison Ave., New York 22, N. Y.—EEH, EEU
Wyeth Eng'g, 8021 Dempster St., Morton Grove, Ill.—EEA
Ziv Television Programs, Inc., 1529 Madison Rd., Cincinnati 6, Ohio—EEH, EEN, EEU

31—Batteries

Dry	**FFA**
Dry, portable	**FFB**
Hearing Aid type	**FFC**
Nickel-Alkaline	**FFD**
Storage, fixed	**FFE**
Storage, portable	**FFF**

Acme Battery Co., 59 Pearl St., B'klyn, N. Y.—FFA
Bond Electric Corp., Div. of Olin Industries, New Haven 4, Conn.—FFB
Bright Star Battery Co., 600 Getty Ave., Clifton, N. J.—FFA, FFB
Burgess Battery Co., Freeport, Ill.—FFA, FFB, FFC
Camera Mart, 1845 B'dway, New York, N. Y.—FFF
Electric Storage & Battery Co., P. O. Box 8109, Philadelphia 1, Pa.—FFE, FFF
Electronic Batteries, Inc., 34 35th St., Brooklyn 32, N. Y.—FFF
Electronic Development Lab., 43-07 23 Ave., Long Island City 5, N. Y.—FFA, FFB, FFE, FFF
Galvanic Products Corp., 110 E. Hawthorne Ave., Valley Stream 10, N. Y.—FFB, FFC, FFF
Gamewell Co., 1238 Chestnut St., Newton Upper Falls 64, Mass.—FFE
General Dry Batteries, Inc., 13000 Athens Ave., Cleveland 7, Ohio—FFA
Kinevox Inc., 116 S. Hollywood Way, Burbank, Calif.—FFB
Mallory & Co., P. R., 3029 E. Washington St., Indianapolis 6, Ind.—FFA, FFB, FFC
National Carbon Co., 30 E. 42 St., New York 17, N. Y.—FFA, FFB, FFC
Nickel Cadmium Battery Corp., Pleasant St., Easthampton, Mass.—FFD, FFE, FFF
Olin Industries, Inc., Electrical Div., Winchester Ave., New Haven 4, Conn.—FFA, FFB, FFC
Radio Corp. of America, RCA Tube Dept., Harrison, N. J.—FFA, FFB, FFC
Ray-O-Vac Co., 212 E. Washington Ave., Madison 10, Wisc.—FFA, FFB, FFC
Sonotone Corp., Box 200, Elmsford, N. Y.—FFD
Specialty Battery Co., 212 E. Washington Ave., Madison 3, Wisc.—FFA, FFB
Willard Storage Battery Co., 246 E. 131st St., Cleveland 1, Ohio—FFB, FFE, FFF

32—Power Supplies

Chargers, battery	**GGA**
Converters, rotary	**GGB**
Converters, vibrator	**GGC**
Regulators, 60 cps.	**GGD**
Regulators, 400 cps.	**GGE**
Sets, generator engine driven	**GGF**
Supplies, AC/DC	**GGG**
Supplies, regulated power	**GGH**
Supplies, special purpose	**GGI**
Supplies, variable frequency	**GGJ**

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Acorn Electronics Corp., Box 348, Gibson City, Ill.—GGG, GGH, GGI, GGJ
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Airpax Products Co., Middle River, Baltimore 20, Md.—GGA, GGC, GGD, GGE, GGG, GGH, GGI
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American Bosch Corp., Springfield 7, Mass.—GGA
American Electroneering Corp., 5025 W. Jefferson Blvd., Los Angeles 16, Calif.—GGD, GGE, GGG, GGH, GGI, GGJ
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Amplifier Corp. of America, 398 Broadway, New York 13, N. Y.—GGH
Ansley Electronics, Inc., 85 Tremont St., Meriden, Conn.—GGI
Antenna Research Lab., Inc., 797 Thomas Lane, Columbus 14, Ohio—GGI
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Audio & Video Products Corp., 730 5 Ave., New York 3, N. Y.—GGH
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Automatic Switch Co., 391 Lakeside Ave., Orange, N. J.—GGA
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Bardwell & McAlister, 2950 N. Ontario St., Burbank, Calif.—GGD, GGE, GGG, GGH, GGI
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Boda Co., 154 & Commerical, Harvey, Ill.—GGF
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Electronic Development Lab., 43-07 23 Ave., Long Island City 5, N. Y.—GGA, GGH, GGI, GGJ
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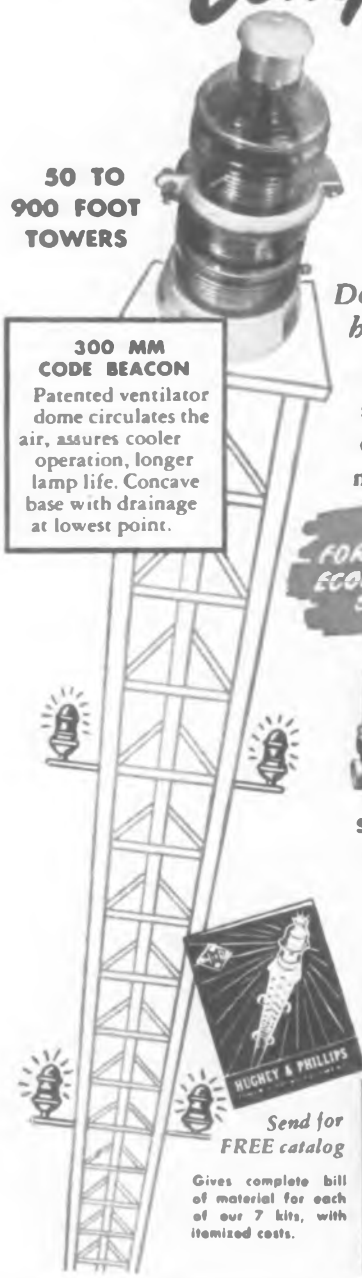

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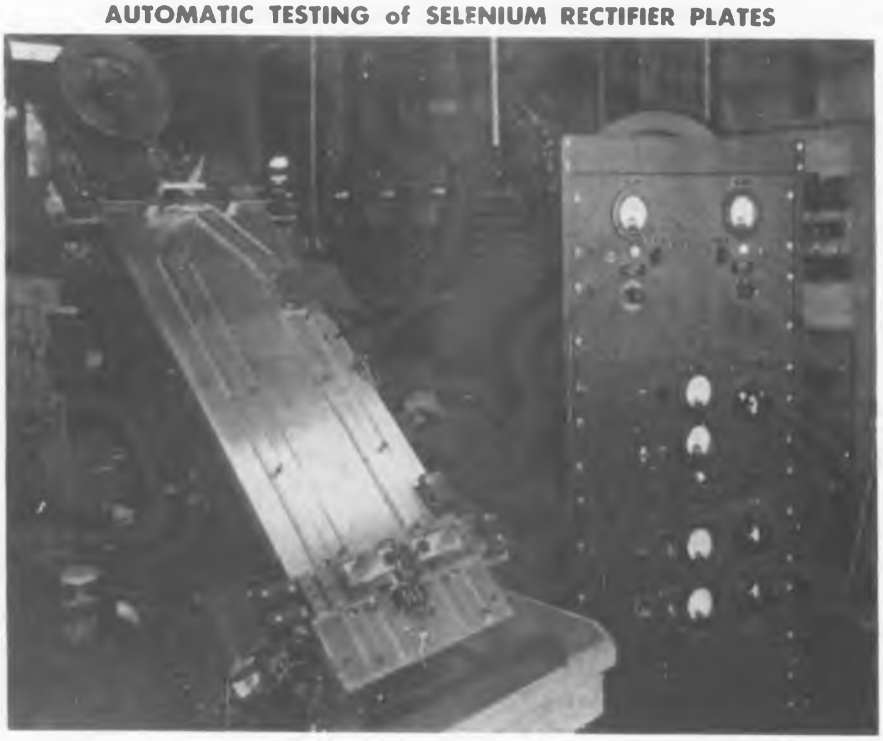

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Kinetix Instrument Co., 902 Broadway, New York 10, N. Y.—KKA, KKB, KKC, KKF
Kleinschmidt Labs., Box 628, Deerfield, Ill—KKA
Kollmorgan Optical Corp., 2 Franklin Ave., Brooklyn 11, N. Y.—KKE
Kollsman Instrument Corp., 80-08 45 Ave., Elmhurst 73, N. Y.—KKA, KKB, KKE, KKF, KKG, KKI, KKJ, KKO
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National Electronics Mfg. Corp., 42-08 Vernon Blvd., Long Island City 1, N. Y.—KKJ
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Vokar, 7300 Huron R. Dr., Dexter, Mich—KKF, KKN
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Bow Solder Products Co., 251 Freeman St., Brooklyn 22, N. Y.—LLD
Buchanan Electrical Prod., Hillside, N. J.—LLF
Bussmann Mfg. Co., University at Jefferson, St. Louis 7, Mo—LLB
Califf Mfg. Co., 45 Washington, W. Orange, N. J.—LLE
Chicago Expansion Bolt Co., 1338 W. Concord Place, Chicago 22, Ill—LLA
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Drake Electric Works, Inc., 3656 N. Lincoln Ave., Chicago 13, Ill—LLE
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Elco Tool & Screw Corp., 1930 Broadway, Rockford, Ill—LLA
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Federal Screw Products Inc., 224 W. Huron St., Chicago 10, Ill—LLA
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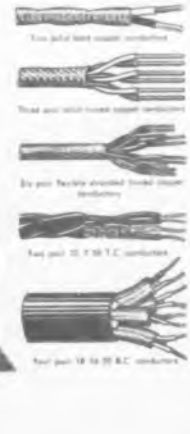

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Dalohm precision deposited carbon resistors offer the best in accuracy, stability, dependable performance and economy. Available in ½ watt, 1 watt and 2 watt sizes.

Carefully crafted in every respect, Dalohm resistors are true power in miniature—provide the answer to those space problems.

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DALE PRODUCTS, INC.

News of MANUFACTURERS' REPS

Morris F. Taylor Co., 8416 Georgia Ave., Silver Spring, Md. has appointed Frank Van Gilder district manager for the eastern Pennsylvania territory. Merrill B. Lamont has joined the company as sales engineer.

B. F. Fitzner Co. has opened new offices at 8803 Michigan Ave., Detroit 10, Mich., to service accounts in Michigan, Ohio and Indiana and the manufacturers it represents.

Marshank Sales Co., 672 S. Lafayette Park Place, Los Angeles has completed a large-scale expansion program. The additions to the staff include: W. J. Monteforte, Peter Pohl, L. B. Winters, and I. R. Stern.

M. B. Squires Co., 1212 Grant Building, Pittsburgh, Pa. has been appointed sales representative for the Cornish Wire Co. on their full list of manufactured products in the Pittsburgh territory, encompassing western Pennsylvania, southeastern Ohio and northwestern Virginia.

JKM, Inc., 510 N. Dearborn Street, Chicago, Ill., has been appointed sales representatives in the Chicago area for Utah Radio Products Co., Inc., Huntington, Ind.

Check up CHECK OUT

with **SIGNAL GENERATORS** by **AIRCRAFT RADIO CORPORATION**

TYPE H-14

108-132 Megacycles
24 omni courses
Left-center-right phase localizer
Left-center-right 90/150 cps localizer

Signal source for bench or ramp testing of VHF airborne omnirange and localizer receivers. RF output for ramp checks, 1 volt into 52 ohms; for bench checks, 0-10,000 microvolts.

Price $885.00 net, f.o.b. Boonton, N.J.

TYPE H-1[illegible] 900-2100 mc. RF signal source, CW or pulse amplitude-modulated. Equal to military TS-419/U.

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TELE-TECH

Advertisers — October, 1952

While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.

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(not by functional sections, with their tendency to narrowness of specialization and limitation of professional growth). Here the member of a project group is in close touch with all phases of the project— responsible for his own share in his particular field but able to see the whole. The engineer in charge of the group, instead of being limited to expertness in producing one kind of unit to be assembled by others, is an executive responsible for ALL phases of the successful completion of the project.

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MELPAR INC. ELECTRONICS

BULLETINS

Magnetic Amplifiers

The first line of Magamp magnetic amplifiers produced by the Westinghouse Electric Corp., Pittsburgh 30, Pa., is described in a new 18-page booklet (TD-52-600). Curves, tables and wiring diagrams are included in sections which deal with component parts, applications and operating characteristics. Copies may be obtained from Westinghouse, Box 2099, Pittsburgh 30, Pa.

Introduction to Microwave

A 20-page booklet, entitled "An Introduction to Microwave," provides a semi-technical description of RCA microwave equipment. Chapter headings include: microwave radio; how it works; propagation characteristics, operational advantages, economic factors influencing choice of frequencies, and desirable design characteristics. Copies may be obtained from the Microwave Communications Section, Radio Corporation of America, Camden 2, N. J.

Digital Printing Counter

An electronic digital printing counter for counting, totaling and printing results from electronic computers, oscillogram readers, test instruments and transducers and a digital read-out machine are the subjects of new bulletins released by Clary Multiplier Corp., San Gabriel, Calif. Typical applications of both pieces of equipment are illustrated and described.

Dual Impregnating Unit

The Red Point Dual Impregnating Unit, designed for impregnation under vacuum of porous articles, such as electric windings, etc., is described in a brochure published by Red Point Products, 1907 Riverside Drive, Glendale 1, Calif. Use of the Red Point dual system is said to accomplish a perfect impregnation within the shortest period of time.

Motor Speed Controls

"Variac® Motor Speed Controls" is the title of an 8-page brochure being made available by the General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass. Technical data presented includes speed-torques curves and typical applications for all models.

TV Camera Chain

Allen B. Du Mont Laboratories, Inc., has published a new bulletin describing the company's universals image orthicon camera chain model TA-124-E. Copies may be obtained from the Television Transmitter Div., Allen B. Du Mont Laboratories, Inc., 1500 Main Ave., Clifton, N. J.

Toroidal Inductor

Precision wound high Q toroidal inductors are listed in Lenkurt's new four-page bulletin TL-P4. Five different types of coils are available with or without hermetically sealed cases. Included in the bulletin are Q curves and other design data for representative standard values of the varied coil types.

Information is also included about the effect of dc current on the inductance values of each type of coil. Copies of bulletin TL-P4 are available nn request from Lenkurt Electric Sales Co., 1116 County Road, San Carlos, Calif.

Telephone Handsets

A combination file folder and catalog sheet, describing the Company's line of telephone handsets and accessories, has been released by the Connecticut Telephone and Electric Corp., 70 Brittania St., Meriden, Conn. The file folder is not only a compact, easy-to-use catalog but contains identifying photographs, descriptive data, wiring diagrams, cordage codes and connection assemblies for various handsets, headsets and wall or desk telephone sets, as well as components, both for military and commercial application.

Miniature Connectors

The Advance D-1 bulletin contains photos, data and dimensional drawings of the "D" series of Cannon connectors. Contact complement ranges from 15 contacts to 50. Suitable for rack and panel mounting, connectors in this series may be used as plugs on either side of the assembly by the addition of a junction shell, having an integral clamp. Copies may be obtained from the Cannon Electric Adv. Dept., 420 W. Ave. 33, Los Angeles 31, Calif.

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CATALOG IMP-1 describes Pyramid's new line of molded plastic tubular capacitors. "IMPS" are rugged — impervious to moisture and withstand a temperature of 100° C.

CATALOG MP-2 gives detailed information on ultra-compact metallized paper capacitors. Minimum size and weight, and self-healing qualities are characteristics of these units.

CATALOG PG-1 lists miniature Glasseal capacitors. These tubular units perform at temperatures ranging from −55° C. to +125° C.

CATALOG J-7 is a 32-page compilation of paper, electrolytic, oil-paper and metallized paper capacitors. Complete data on eighteen different types, including construction variations, sizes and prices are listed.

Free copies of these colorful, attractive publications are available on letterhead request to Dept. T2

PYRAMID ELECTRIC COMPANY

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RCA VIDICON

TECHNICAL FEATURES

- √ Only 6¼" long and 1" in diameter
- √ Provides 400-line resolution
- √ Spectral response approaching that of the eye
- √ Sensitivity permits televising with 100-200 foot-candles of illumination
- √ Designed for use with commercially available camera lenses
- √ Operates with low dc voltages

ACTUAL SIZE →

NEW, small-size camera tube for low-cost industrial television

Now, the RCA developed 6198 Vidicon extends the advantages of television coverage to countless industrial users . . . opens the door to simplified television camera designs.

The small size and simplicity of operation of this television camera tube facilitates the design of compact and low-cost television camera equipment – including equipment for closed-circuit, portable, and remote-control applications.

Produced in the same plant by the same skilled hands that make the RCA Image Orthicon camera tube, the RCA-6198 offers the detail of 400-line picture quality at low unit cost. It employs magnetic focus and deflection, and operates with relatively low dc voltages.

Utilizing a photoconductive layer as its light sensitive element, the RCA-6198 has a sensitivity which permits televising scenes with 100 to 200 foot-candles of incident illumination. The photoconductive layer has a spectral response characteristic approaching that of the eye. The dimensions of the useful area of this layer are such that stock camera lenses can be employed. The size and location of the layer permit a wide choice of commercially available lenses.

The following components, designed for use with the RCA-6198 Vidicon, are also available:

RCA-216D1 Deflecting Yoke
RCA-217D1 Focusing Coil
RCA-218D1 Alignment Coil
RCA-233T1 Horizontal Deflection Transformer
RCA-234T1 Vertical Deflection Transformer

For complete data on the RCA-6198 Vidicon and associated components, write RCA, Commercial Engineering, Section JR57, Harrison, N. J., or contact your nearest RCA Field Office.

FIELD OFFICES: (East) Humboldt 5-3900, 415 S. 5th St., Harrison, N. J. **(Midwest)** Whitehall 4-2900, 589 E. Illinois St., Chicago, Ill. **(West)** Madison 9-3671, 420 S. San Pedro St., Los Angeles, California.

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